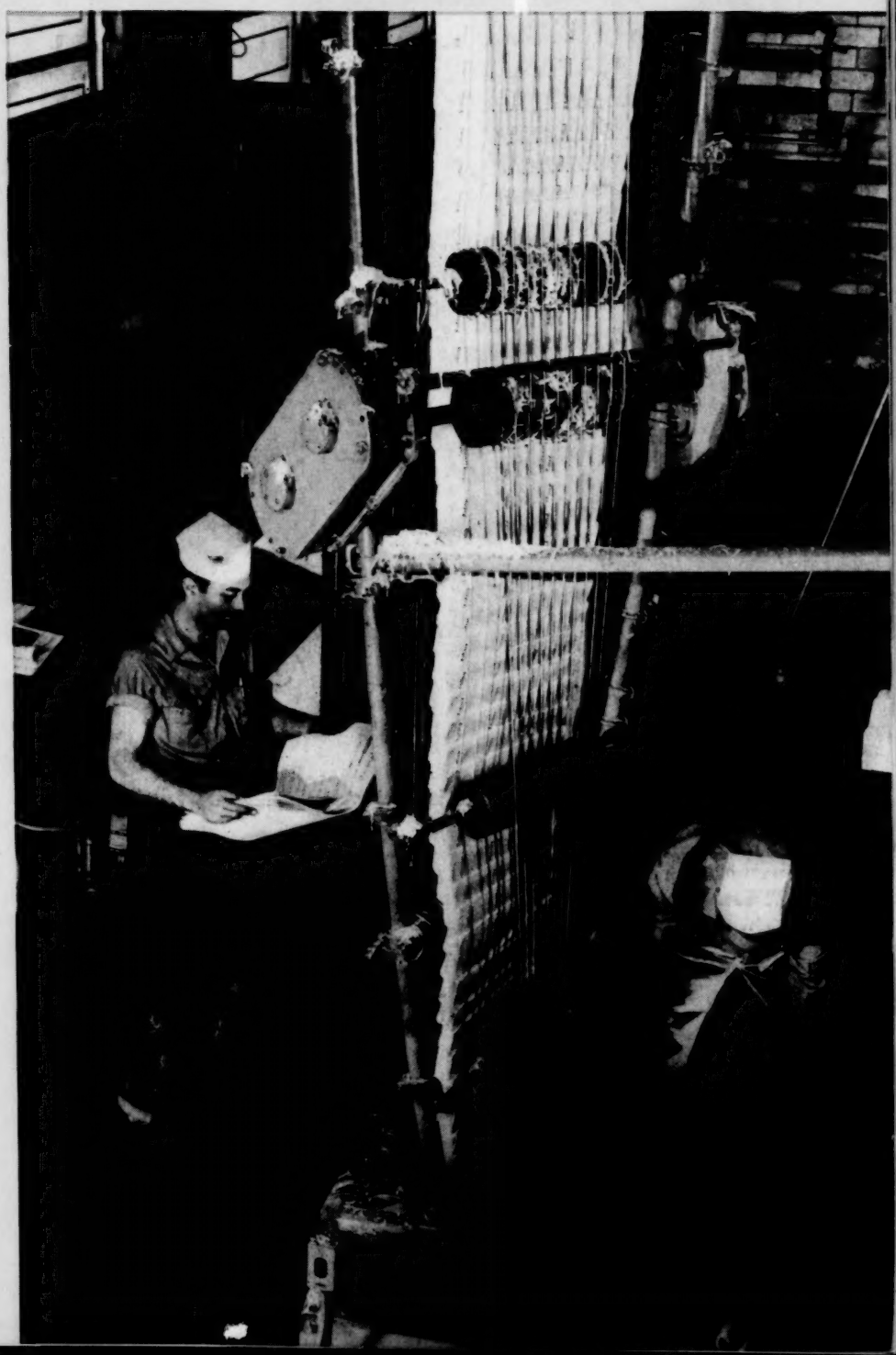
AIR CONDITIONING HEATING AND VENTILATING

AUGUST 1959

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT

ine self-contained water cooled units rovide spot cooling in the press room of ewsday, a daily newspaper. Spot cool- g reduced estimated air conditioning ad for entire plant from 260 to 55 tons. Page 53)



IN THIS ISSUE

eference Section on Design nd Use of Heat Pumps .. 69

elector Chart for Air Filters ased on Uses and Cost .. 62

ffect of North Wall Orien- ation on Cooling Load ... 88

eport of Annual Meeting f ASHRAE; Hess President 85

rocess and Comfort Cool- ng for Printing Plants ... 53

esigning and Locating eptic Tank Systems 90

ontrol of Humidity and ust in Telephone Ex- hanges 59

ew Data on Solar Radia- ion on North and South alls 64

ata Sheet on Discomfort ndex (Concluded) 81

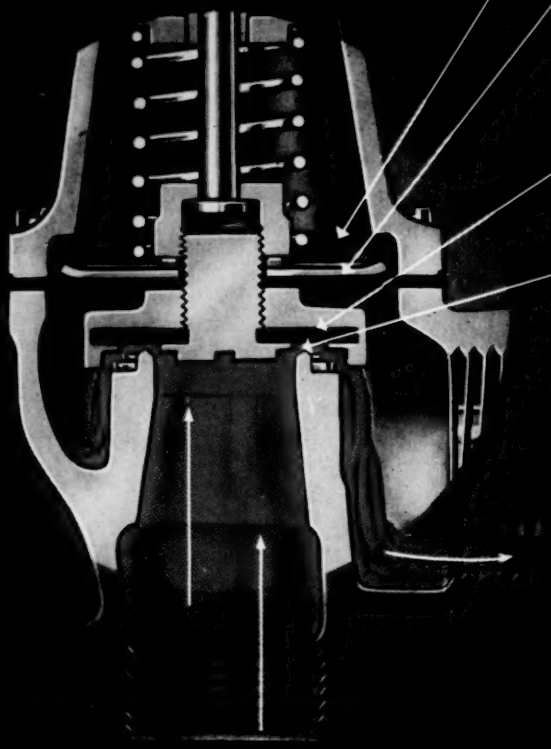
etail Sheet Covering Gas eter Connections 83

ew Literature 97

ew Equipment 100

d Digest 149

WATTS
No. 174A



Double-Safe Design — No mechanical guides—not diaphragm operated.

Water Seal — Provides precise alignment of seal to disc and eliminates need of hazardous mechanical guides which can stick or freeze a valve shut from lime or corrosion. Seal also protects spring working parts from water or steam during relief.

Stickage-free Disc-to-Metal Seating — heat resisting, stickage-proof silicone disc material.

Pop Action Operation—All Watts A.S.M.E. rated relief valves operate by pressure exerted directly against the disc to pop the valve wide open for steam relief. The full rate of discharge is immediately reached at the set opening pressure and does not depend on further pressure accumulation as in some other designs.

WHAT DO YOU LOOK FOR IN ASME PRESSURE SAFETY RELIEF VALVES?

ENGINEERING DESIGN

The most advanced design in A.S.M.E. rated pressure relief protection for hot water boilers is the new *Double-Safe* design of Watts Valves.

These are water pressure relief valves with an *emergency* steam rated pressure safety relief feature. They will discharge excessive water pressure created by thermal expansion and also excessive steam pressure in the event of emergency temperature conditions.

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Watts offers the most complete line of boiler safety relief valves with the 174A Series and 74A-740 (expanded outlet) Series. Designed to meet the smallest or largest requirements for pressure protection from one line of valves, Watts A.S.M.E. Rated Relief Valves furnish complete protection for the great majority of hot water heating and supply boilers *with a single valve.*

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Watts A.S.M.E. Rated Pressure Relief Valves are available in capacities from 500,000 BTU/HR to 14,370,000 BTU/HR with valve settings from 30 to 150 lbs.

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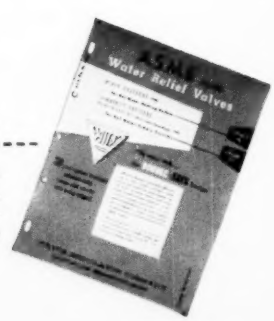
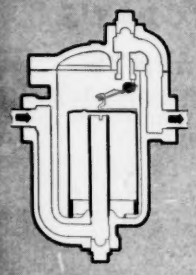
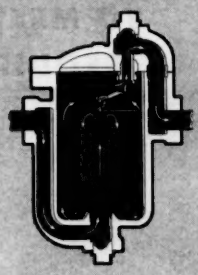
Ratings, and Application Information on Watts A.S.M.E. Rated Valves, see your wholesaler or send for Bulletin F-ASME.



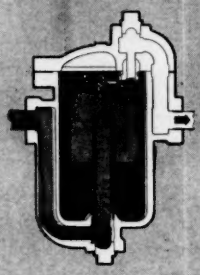
This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam



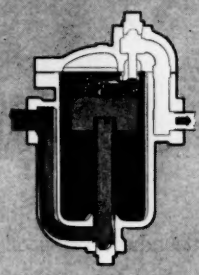
When trap is first installed, the inverted bucket is down and the valve is wide open.



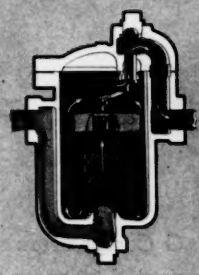
When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —



Steam (light color) reaching the trap floats the inverted bucket and closes the valve.



When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.



When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

Key: condensate steam steam bubbles air bubbles

ARMSTRONG INVERTED BUCKET STEAM TRAPS

are designed and made to give you these big benefits:

● Amstrong Traps, the first inverted bucket steam traps, now represent the most advanced development of this time-proven principle. They provide all the advantages necessary for efficient, economical condensate drainage from virtually all types of steam using equipment.

1. *No steam loss* – Steam never reaches the orifice even when there is no condensate load.
2. *Automatic air elimination* – Vent in trap bucket passes air and other non-condensibles through to be discharged with condensate.
3. *No cooling leg required* – Condensate is discharged at steam temperature as fast as it reaches the trap because trap operates on difference in density between steam and water not on temperature.
4. *Operates on any back pressure* — Failure of one trap in system will not cause others to open because high back pressure does not affect an Armstrong trap other than to reduce capacity. As long as there is a pressure differential across the orifice the trap will close on steam and open for condensate.
5. *Unaffected by ordinary dirt* — Swirling action of condensate keeps dirt in suspension until discharged with condensate, prevents it from lodging in valve.
6. *Completely dependable* — Proved design plus the use of all stainless steel working parts assure continuity of service and length of service unmatched by any other trap.
7. *Big capacity in a small, economical package* — Armstrong design gives you the highest practical capacity for any given pressure. And remember, Armstrong capacity ratings are based on *hot* condensate at the *working pressure differential* stated, not on theoretical orifice capacities.

Further information on these advantages plus much additional information is given in the 48 page Armstrong Steam Trap Book. Ask your local Armstrong Representative or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

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quiet *vibrationless*

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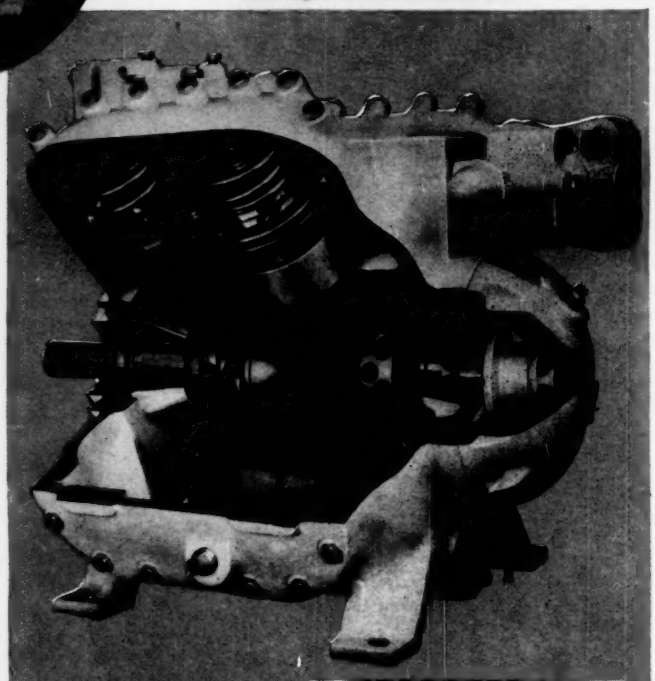

B&G Compressors are *not* adaptations of designs originated 20 years ago—they are completely new in conception, engineered to establish higher standards of performance. Foremost of their many features is quiet, vibrationless operation—and here B&G Compressors have no equal.

This is concrete evidence of quality! It indicates the precision manufacture of a basically superior design. B&G Compressors have fewer parts, present fewer maintenance problems. All units have *one* bore diameter—a few interchangeable parts will service them all.

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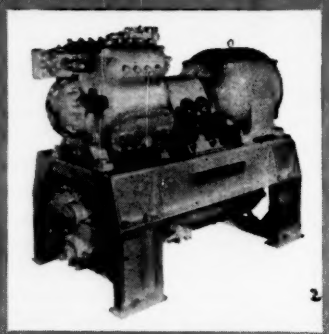
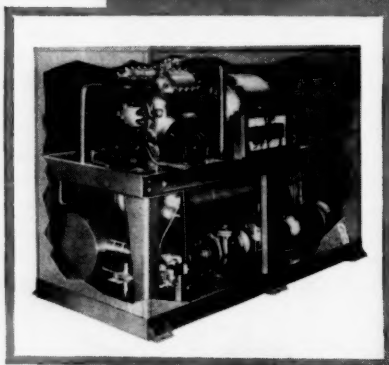
All these things add up to greater efficiency—greater value per dollar. Remember, too, that all major parts of B&G "package" units are made and guaranteed by Bell & Gossett Company.





Send for complete file of specifications and application data on B&G Air Conditioning and Refrigeration equipment.

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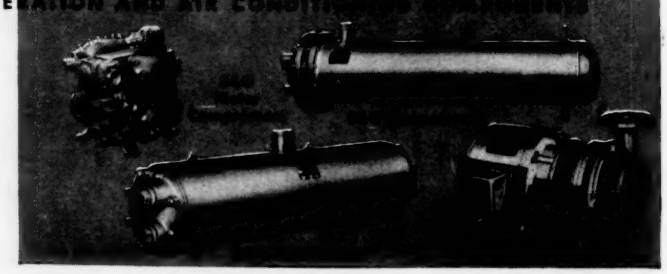

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AIR CONDITIONING HEATING AND VENTILATING

Volume 56, Number 8 **August, 1959**

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AIR CONDITIONING

Air Conditioning Printing Plants 53
Recommended procedures and systems to use .....R. S. Arnold

VENTILATION

Ventilation for Telephone Exchanges 59
Best environment for equipment .....H. C. Rossing

AIR HANDLING

Air Filter Selection Data 62
Chart based on latest BRAB survey.

SOLAR RADIATION

Solar Radiation on Walls Facing North and South 64
Additional data from Blue Hill Observatory .....C. V. Cunniff

HEATING AND COOLING

Reference Section—Design and Use of Heat Pumps 69
Methods for achieving economy .....J. R. Harnish

PSYCHROMETRICS

Data Sheet—The Discomfort Index (Concluded) 81
New table gives DI values at a glance.

PIPING

Detail Sheet—Piping Connections 83
Five-light gas meter hookups.

ASHRAE MEETING

Window Shading, Ventilation, Refrigerants 85
among subjects at Society's annual meeting.

ENVIRONMENTAL CONTROL

Controlled-Climate Facilities for Biologists 87
Laboratory will study effects of environment on plants and animals.

AIR CONDITIONING

How Cooling Load Varies with North Wall Orientation 88
Solar load changes in each of four zones .....S. Daryanani

PLUMBING

Optimum Piping for Hot Water Storage Tank 89
Iowa study for NAPC gives key to maximum output.

DEPARTMENTS

High Spots in the News 4
Washington Overtones—L. Overman 8
News of the Month 12
Scientific Frontiers 16
Picture Paragraphs 68
Piping and Plumbing—L. Blendermann 90
Degree-Days for June, 1959 94
Product Applications 96
New Literature 97
New Equipment and Materials 100
Book Reviews 122
What Readers Say 124
Coming Events 126
Briefly Stated News Items . 134
Index to Advertisers 147
Ad-Digest 149

HIGH SPOTS

♦ **Experimental production of a light-wall seamless metal tubing, called Strubing, that can be shipped in ribbon form and inflated at the point of use,** was announced by Wolverine Tube Div., Calumet & Hecla, Inc., Allen Park, Mich. According to the company, the tubing holds promise of major innovations in many industries. It might be possible, for instance, to ship the entire ductwork for the heating system for a seven-room house in a box the size of an orange crate. The ribbon would then be strung through the house and then inflated in place. In addition to economical transportation, Strubing manufacture should be much less expensive than current thin-wall tube production. Tube can be made in sizes smaller than a lead pencil, large enough for a man to walk through.

♦ **A Navy contract for design of an air conditioning system for submarines based on thermo-electric refrigeration** was awarded Radio Corporation of America, Camden, N. J. The company states that the system will be more rugged, compact, and flexible than conventional cooling apparatus.

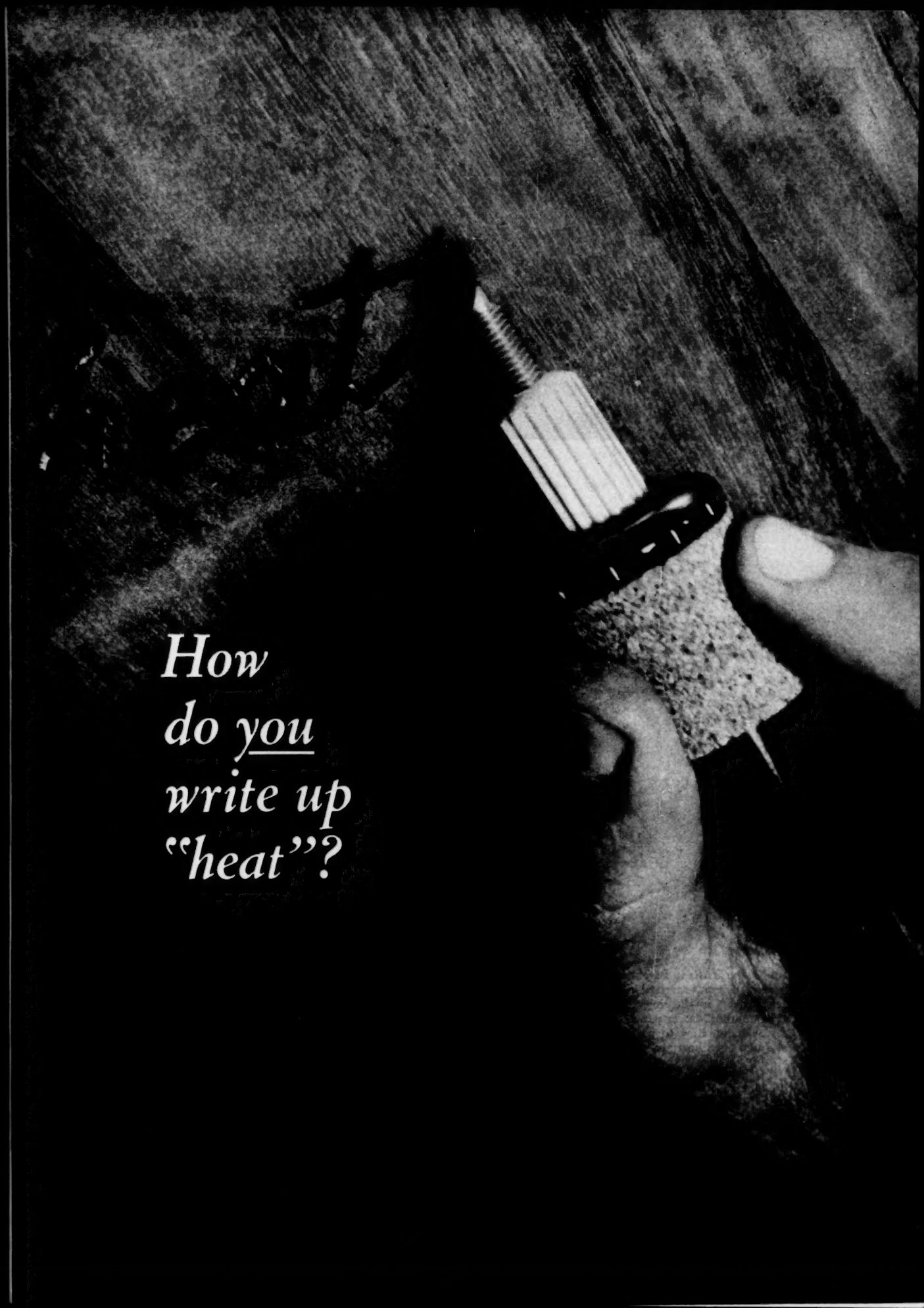
♦ **Installed cost of central-station air conditioning systems which went into operation in multi-room buildings and commercial and industrial applications in the United States during 1958 is estimated at $550,730,000** by Air-Conditioning and Refrigeration Systems Section, Air-Conditioning and Refrigeration Institute, Washington, D.C. This figure is eight percent below the estimated 1957 installed value of the big systems ($598,900,000) but is still ahead of any other previous year. About half the volume was installed to condition multi-room buildings such as offices and apartments. The rest was about equally divided between commercial and industrial installations.

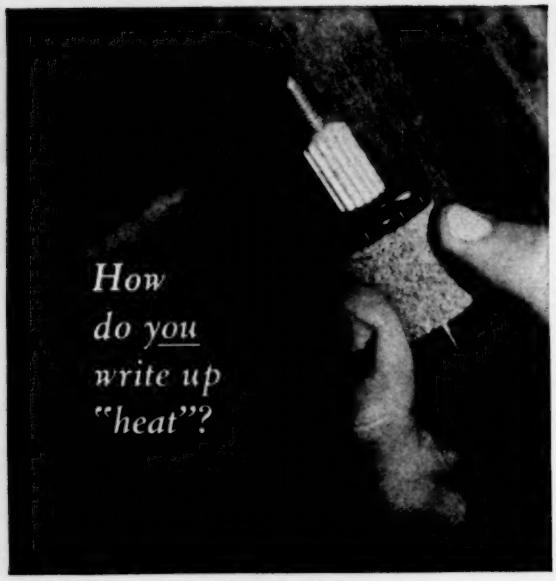
♦ **Most Russians visiting the American National Exhibition in Moscow are being exposed to air conditioning for the first time.** American room air conditioners on display are in operation. Two Carrier portable models, which double as heat pumps, demonstrate that cool or warm air can be obtained from opposite sides of the same unit. Air conditioning is also at work cooling a color television studio and an electronic computer exhibit. Visitors to the Soviet Union say there is virtually no comfort air conditioning evident in homes or public places there.

♦ **"The first and last thing a man does is take a breath. Is his air pure? The answer is No.** His air has never been pure, but with each passing decade it becomes more impure. We strongly suspect that in many cases the length of time between the first breath and the last would be both longer and pleasanter if the air were better. . . .

"The first public recognition of the contemporary problem of air pollution occurred in Los Angeles in the early 1940's. There, for the first time in history, air pollution could not be equated with smoke. Solid fuels were hardly used, yet air pollution came and grew, and persists today as a critical problem, despite ten years of control action more costly and restrictive than that ever placed on citizens and industries by any government in history.

"Los Angeles is partly ringed by mountains and subject to winds that don't blow hard enough. It presents an environment so conducive to the build-up of pollutants that some authorities once optimistically suspected that the problem was unique to that area. The more mature observation of the present, however, indicates that the problem faced by Los Angeles is by no means unique. The same kinds of plant damage and eye irritation which characterize air pollution there is being observed frequently nowadays, not only elsewhere in California, but in many other parts of the country as well. **Present trends in fuel usage and in the diversification of industrial and domestic activities indicate that the pattern provided by Los Angeles is one toward which other metropolitan areas are moving."**—Richard A. Prindle, M.D., Chief, Air Pollution Medical Program, U.S. Department of Health, Education, and Welfare, Public Health Service.


How
do you
write up
"heat"?



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You can simplify your next electric heat job when you look to Ilg.

In the first place, you have a choice of electric units broad enough to cover almost every *type* of installation . . . every *capacity* need. Radiant baseboard, wall insert

Here's why ILG *electric let you*

Finishing Touch. **Ilg Radiant Baseboards—in 2', 5' and 8' lengths for surface or semi-recessed mountings—are simple to install. Back panel with heating element attached either nails or screws to studding. Cover panel, end covers and corner pieces snap on by hand. Easy to paint to match any decor. Provide clean, quiet, even heat along outside walls.**

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And for your convenience in specifying, Ilg offers a new Electric Heat Manual—a handy, easy-to-use source of factual information that covers the entire line, that simplifies all calculations, that shows how to install all Ilg electric heat units, that lists detailed specifications.

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WASHINGTON OVERTONES

by LORING F. OVERMAN

● The air-conditioned coolness of Capitol Hill and its legislative halls and spacious Congressional offices appears to have taken the heat out of demands for big-spending.

There's still smoke enough to signal smoldering sparks under the surface. But by mid-July the record showed:

—veto of a housing bill which started off with a $2.2-billion price tag.

—an airport bill increasing aid to $100 million a year was cut back to $63 million.

—area development bill passed the Senate at $390 million, was reduced to $251 million by a House Committee, and was expected to be vetoed if actually passed.

—bill providing $1 billion in Federal funds for loans to cities' public works, passed by Senate, not acted upon by House.

—a $4.4-billion aid-to-education bill won House Committee approval; was stymied in House Rules Committee, and may yield to $1.3-billion program advocated by the Administration.

—other Congressional economies included trimming $164 million from requests to run government agencies.

● That the steel strike and others of similar scope are not merely family quarrels was evident in mid-July when Senate Majority Leader Lyndon B. Johnson requested Treasury Secretary Robert B. Anderson to estimate how much the strike would cost the government per week in tax revenues. Mr. Johnson's questions were, How much will be lost to the Treasury each week:

—in revenues that would otherwise be paid out of profits made by steel companies?

—from taxes that would be collected out of wages that would otherwise be paid to steel workers?

—by taxes that would otherwise be paid from profits and wages by such related industries as would be affected by the strike?

—in refunds to industries that have paid their taxes on the basis of incomes that did not take into account the steel situation?

Mr. Johnson's final quesion: How will all this affect Treasury's estimate of the balanced budget for the fiscal year beginning July 1 if the strike lasts one month; two months; longer?

● Problems of appropriations, housing, labor, minimum wage changes, and other "musts" promise to keep Congress on the job through August. September 1 has been mentioned as an adjournment target; September 15 is considered more likely.

● Public hearings scheduled for July 23 were expected to determine whether Congress would try to pass the vetoed omnibus housing bill or try for a compromise.

Senator John Sparkman (D-Ala.), sponsor of the vetoed measure and chairman of the Senate Banking Housing Subcommittee said Administration witnesses would be required to give a line-by-line explanation of official objections to the bill.

Meanwhile Congressmen McDonough (R-Calif.) and Widnall (R.-NJ) had introduced identical compromise bills (HR 8181 and HR 8190). The bills are patterned after proposals made previously by the Administration.

The new bills would:

—provide immediate authorization for five billion dollars for FHA mortgage insurance; additional five billion to come later.

—increase mortgage ceiling on single family homes to $25,000.

(Continued on page 10)

National Bank of Detroit

Outstanding example of Detroit's new "Airy" downtown plan . . .

Albert Kahn Associated Architects and Engineers, Inc.
Architects-Engineers

Bryant & Detwiler Co.
General Contractor

J. Brodie & Son, Inc.
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Aerofin's modern SMOOTH FIN design permits use of high air velocities without turbulence or excessive resistance – provides ample heat-exchange capacity in limited space.

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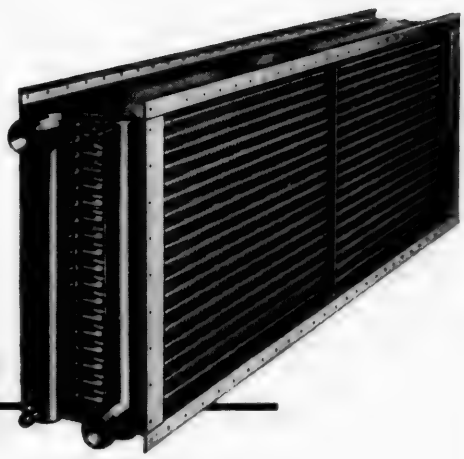

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ENGINEERING OFFICES IN PRINCIPAL CITIES

WASHINGTON OVERTONES *(Continued from page 8)*

—Raise interest rates on rental and cooperative management housing to 5½%, and on cooperative sales housing to 6%.

Omitted are the following controversial provisions:

—public housing funds and direct loans for housing the elderly.

—increased maturity for FHA mortgages.

—requirement that FNMA buy mortgages at par.

—FNMA special assistance authorization for cooperatives.

—new secondary mortgage FNMA loan program.

—authorization for hospital construction, and for savings and loan associations to lend for land developments.

The new bills do, however, authorize $600 million for urban renewal over a two year period, and $200 million to continue college housing programs.

● Labor legislation, if any be enacted, may be limited to internal affairs of unions. Business is still pressing for action to strengthen methods of coping with secondary boycotts, abuses of organizational picketing and similar tactics. Organized labor, on the other hand, is urging concessions.

A Senate subcommittee has approved S-1046, increasing the minimum wage to $1.25 an hour and extending coverage to 10 million workers. Passage by the Senate at this session is possible. House action may depend upon viewpoints expressed by constituents.

● "Money musts" acted upon by Congress, and which would otherwise have expired on June 30:

—Present "Korean war emergency" corporate and certain excise taxes extended for one year.

—Renegotiation Act extended for three years; provisions made for committee investigation of procurement practices.

—Permanent debt limit increased to $285 billion; temporary debt ceiling increased to $295 billion for one year.

● Heating and cooling devices of unconventional types may be dividends of the Naval Research Laboratory's studies of thermoelectric generation systems. NRL's second status report indicates early placing of additional contracts to develop commercial applications.

Navy, as implied by recent contracts with Carrier Corporation and Westinghouse, is concerned with shipboard thermoelectric power generation and cooling.

Army and Marine Corps are interested in thermoelectric generation for ground vehicles. Marine Corps also wants miniaturized units to heat or cool individual clothing, including body armor.

Space agencies are concerned with heating, cooling, and auxiliary power for missiles and satellites.

NRL's report indicates that improvement of materials must be the next step. Contemplated is 18-month program focused on extreme temperature ranges—to 2,000 degrees—on theory that intermediate ranges can be estimated.

● Increasing consumption of electric power on farms, as reported by the Agriculture Department, again signals the importance of the farm market as an outlet for products of the heating, ventilating and air conditioning industries.

Average of 472 kilowatt hours per farm during 1958 established a new record. For 1957 the average was 415, with 195 kwh the 1947-49 average. Increases last year varied from 10% in Middle Atlantic states to 18% in the East South Central states. Pacific Coast states lead in power consumption per farm, with irrigation pumps an important factor.

● Departments of Defense and Agriculture have indicated an interest in entering displays at the 11th Air Conditioning and Refrigeration Industry Exposition, November 2-5 in Atlantic City. They would show the many essential applications of refrigeration and air-conditioning to the Nation's defense and food supply.

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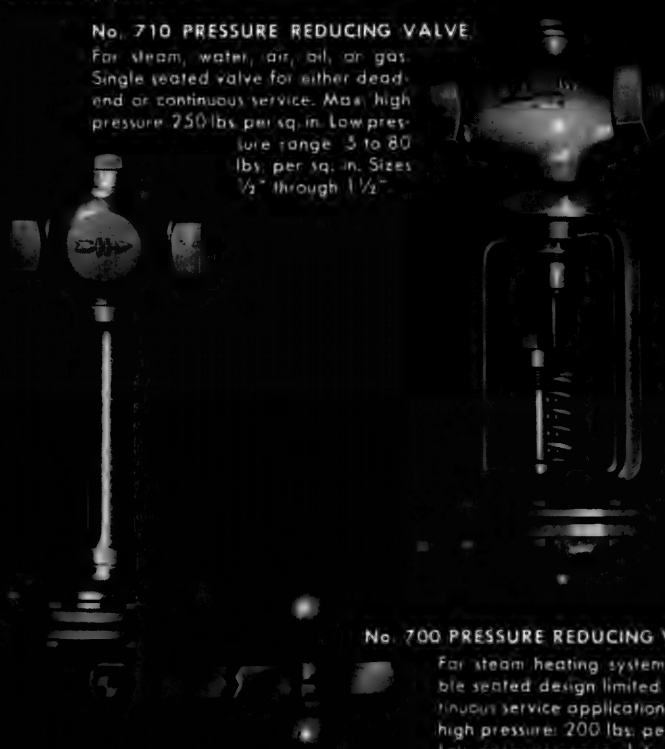
STEA

Half a century of specialized engineering and production experience provides a complete *quality line* of precision products for industrial, institutional, and residential Steam Heating Systems. For example, here are just two from Hoffman's line of Pressure Reducing Valves. They will reduce the pressure of fluids from a higher initial pressure to a lower secondary pressure.

No. 710 PRESSURE REDUCING VALVE

For steam, water, air, oil, or gas. Single seated valve for either dead-end or continuous service. Max. high pressure 250 lbs. per sq. in. Low pressure range .5 to 80 lbs. per sq. in. Sizes ½" through 1½".



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For steam heating systems. Double seated design limited to continuous service applications. Max. high pressure: 200 lbs. per sq. in. Low pressure range: 1 to 15 lbs. per sq. in. Sizes ½" through 8".

Whether your need is for improved design Pressure Reducing Valves, Traps or Pumps, simply call your local Hoffman wholesaler, or write for free literature.

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NEWS OF THE MONTH

U. S. AIR FORCE

holds conference on refrigeration and air conditioning at Wright-Patterson Air Force Base, Ohio.

Mechanical cooling has developed into an important phase of Air Force functioning. Should the present rate of mechanical cooling installations continue, it is expected that by 1960, the Air Force will have equipment totalling 500 million dollars. To keep its personnel informed of the latest advances in air conditioning and refrigeration, a U. S. Air Force Refrigeration and Air Conditioning Conference was held at Wright-Patterson Air Force Base, Dayton, Ohio, July 13 through 16 during which over 30 papers were presented.

More than 320 persons attended this conference, with about equal numbers among the groups of Air Force personnel, government employees, and engineers from private industry.

Ninety percent of the mechanical cooling in the inventory of the Air Force is used to increase the proper operational capability of mechanical and electrical equipment, and about 10% is used for personnel cooling in administrative areas. Of this 10%, less than 2% is used for cooling in living quarters.

At present, some thought is being directed to the cooling of quarters of enlisted personnel who are stationed in areas where periods of high weather discomfort are common, as in the South Pacific zone.

The group was welcomed by Lt. Gen. W. F. McKee, Vice Commander of the Base, and Brig. Gen. E. B. Cassady, Director of Personnel and Support Operations.

Wright-Patterson is the largest Air Force base, and there are 30,000 persons at this base including Air Force and civilian personnel.

John M. Ferry, Special Assistant for Installations, Office of the Secretary of the Air Force, pointed out that air conditioning has extended far beyond the cooling of the home. It has become an essential part of SAGE, computer rooms, missiles, and so forth, and the cost of making the required cooling installations, becomes insignificant in relation to the technical results achieved. Equipment is saved and better results are obtained. However, there is a major need to train the Air Force in the proper air conditioning and refrigeration methods.

Maj. Gen. A. M. Minton, Director of Civil Engineering, Headquarters, U. S. Air Force, in his talk mentioned that the Air Force is the largest customer of the air conditioning industry. While at present maintenance is no problem, it is expected that as the equipment begins to show wear, that maintenance will develop into a major headache during the next two or three years. He said, "We are living in a fool's paradise because equipment is new and attention will have to be given to maintenance."

Most complicated installations of the Air Force are in remote spots

(Continued on page 14)

GHANAIAN STUDENTS STOP AT YORK

Five engineering students from Ghana, a new country on the western coast of Africa, made the first stop on a nationwide industrial tour at the York Division of Borg-Warner Corporation, York, Pa.

The students, whose ages range from 25 to 29, are part of a group from Ghana who are making the tour under the auspices of International Cooperation Administration. They have been provided scholarships by sponsors in Ghana for academic training in the United States and Canada in civil and mechanical engineering.

The five students are John K. Adadevoh, majoring in mechanical engineering at the University of Wisconsin; Walter G. K. Adanuvo, mechanical engineering, McGill University; Osei K. Bonsu, mechanical-aeronautical engineering, Oregon State College of Engineering; Solomon P. K. Daidzie, mechanical engineering Drexel Institute; and Ofei Saakwa-Mante, civil engineering, Swarthmore College.

On their arrival at York, they were met by David A. Schrom, general works manager, who explained the company's operation. They were then taken on a tour of the production facilities by Fred C. Bahr, Jr. and Paul J. McDaniel, both graduate student engineers employed by the company.

The other five students in the group spent the day at the Hydraulic Division of Allis-Chalmers Co.

There's still time to get your
FREE GENETRON CARRY-STAND

(If you haven't already got yours, get it now!)

Offer good through August with purchase of 22 lbs. or more of

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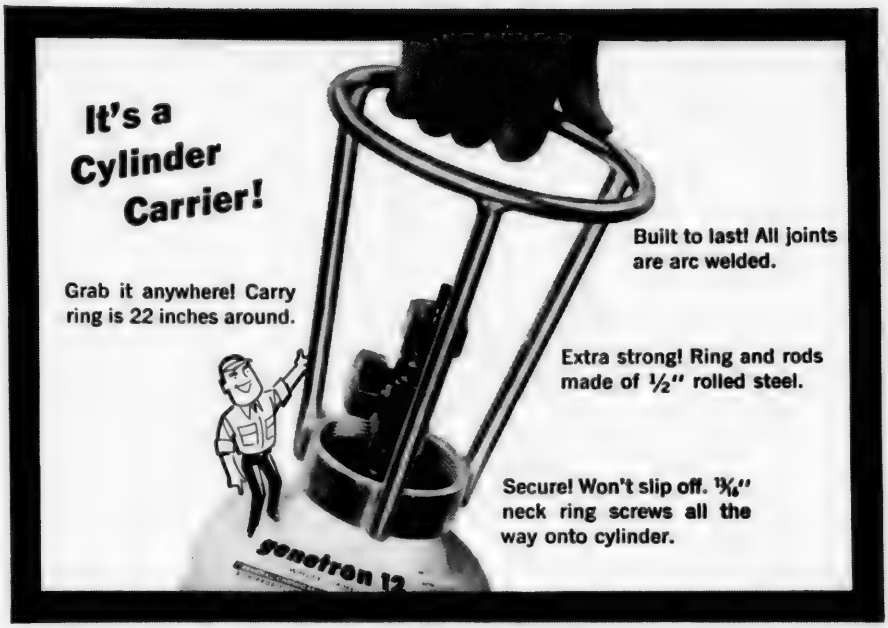
It's a Cylinder Carrier!
Grab it anywhere! Carry ring is 22 inches around.
Built to last! All joints are arc welded.
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Secure! Won't slip off. 13/16" neck ring screws all the way onto cylinder.
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Interchangeable!

Ideal for service use. Use on any 10 lb. or 25 lb. refrigerant cylinder.

Big Value!

Worth at least $5 retail! Yours free when you buy "Genetrons" during August. Don't miss it!

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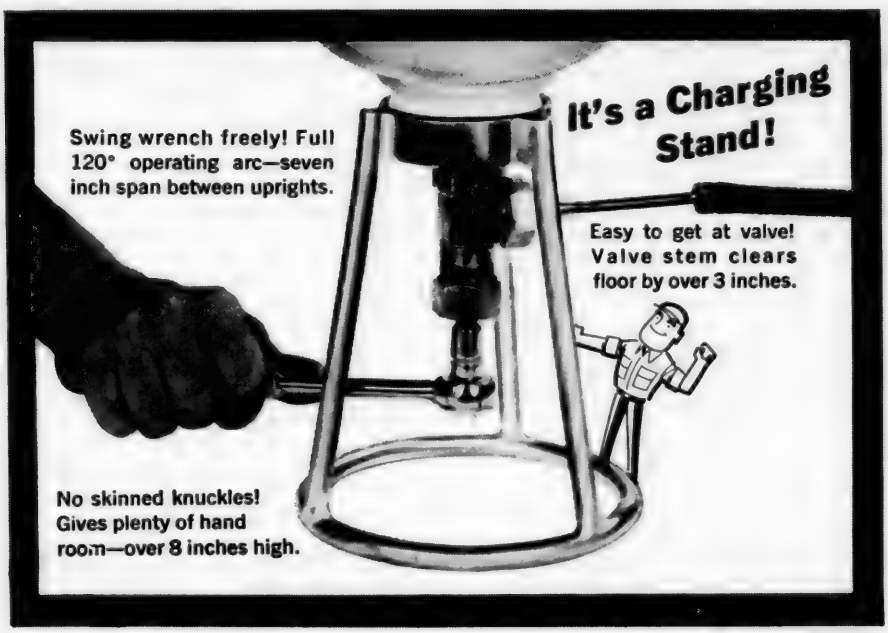
Only One to a Customer!


It's a Charging Stand!
Swing wrench freely! Full 120° operating arc—seven inch span between uprights.
Easy to get at valve! Valve stem clears floor by over 3 inches.
No skinned knuckles! Gives plenty of hand room—over 8 inches high.

Allied Chemical

GENERAL CHEMICAL DIVISION

40 Rector Street, New York 6, N. Y.

(Continued from page 12)

away from good service stations. It is important to have the greatest reliability of the equipment installation. The operation of these very expensive installations are dependent on the proper functioning of comparatively inexpensive air conditioning equipment.

The Air Force is wholeheartedly back of the ARI program for certification of equipment, and one development will be that in the near future, the Air Force will require the certification of all equipment that it purchases. Reliable equipment is necessary so that the Air Force can get away from major maintenance problems.

The conference was arranged by William T. Smith, Headquarters, USAF. In outlining the purpose of this meeting, he called attention to the fact that in 1950, the cost of maintenance of air conditioning and refrigeration equipment was less than 3 million dollars, that this figure had built up to 8.5 million by 1956, and if the present rate of increase continues, it will build up to 10 million by 1960. He hoped that as a result of this meeting and the exchange of information, that it would be possible for the Air Force to obtain better air conditioning systems at less cost.

At the conference dinner, the principal speaker was Paul M. Augenstein, president, Airtemp Division, Chrysler Corp. He said, "The air conditioning industry cannot help but view the Air Force with a distinct feeling of pride. We are proud of the part that our industry has played and will continue to play in the accomplishment of your objectives.

"Apparently you feel no qualms concerning the expenditure of public funds for process air conditioning which maintains temperature or climate to enable inanimate complex machinery or weapons—and the devices that deliver these weapons—to perform in their most efficient manner. If this be true, then why should there be any hesitancy in asking for similar funds in making the people who design, produce, maintain or operate these same materials, perform their functions at the highest point of efficiency."

FABULOUS FUTURE

forcast for electric power market. Forum sees electric heating, air conditioning in major role.

Since 1944, Westinghouse Electric Corporation has invited the leaders of the electric utility industry, every five years, to a review of the future of the electric power market. A capsule version of the Fourth Future Power Conference, originally a two-day affair in Pittsburgh, was held recently in New York City.

This look at a bright future power market was divided into three parts: industrial, commercial, and residential. While each division has its own particular complexities, each had aspects of interest to heating and air conditioning designers.

Industrial: As all the advantages of air conditioning to industry become fully realized (i.e., profit making items such as decreased accidents, decreased absenteeism, improved quality, and increased productivity), great increases in this equipment should be seen. Present *total* air conditioning power use in the United States is 23-billion kwh, of which only 300,000 kwh serves industrial air conditioning. While estimated figures are not available for industrial air conditioning, *total* air conditioning power requirements should reach 45-billion kwh in 1963 and 67-billion kwh in 1968.

Commercial: The staggering sum of $500,000,000,000 is the estimated value of all the existing buildings in the United States. The next decade will see the same amount spent in new construction, with an additional $250,000,000,000 going for modernization and maintenance of existing buildings.

A load-building part of this contemplated construction could be (and should be, with the proper leadership, according to Westinghouse) controlled climate for large public areas. Commercial proprietors can expect an average of only 150 good shopping days, weatherwise, per year. By contrast, in Southdale Shopping Center, near Minneapolis, seventy-five stores circumscribing a glass-enclosed mall enjoy 365 good shopping days each year in an ambient temperature of 72 deg F. Leadership, mentioned above, should come from power companies in their contacts with consulting engineers, architects and electrical contractors, who largely determine the direction of commercial money for construction.

Residential: Electric heating and cooling, as promoted by Westinghouse through the Gold Medallion program and the Total Electric Home concept, is seen as the major factor capable of sustaining the previous residential power growth rate. Power for residential electric heating and cooling should increase its part of the total load by 6% in 1968 and by 13% in 1978. In terms of electrically-heated homes, a moderate estimate by the company foresees the present 500,000 homes reaching 2,200,000 by 1968, 8,000,000 by 1978, with a *possibility* of 4,000,000 by 1968 and 20,000,000 by 1978.

RECORD BUDGET

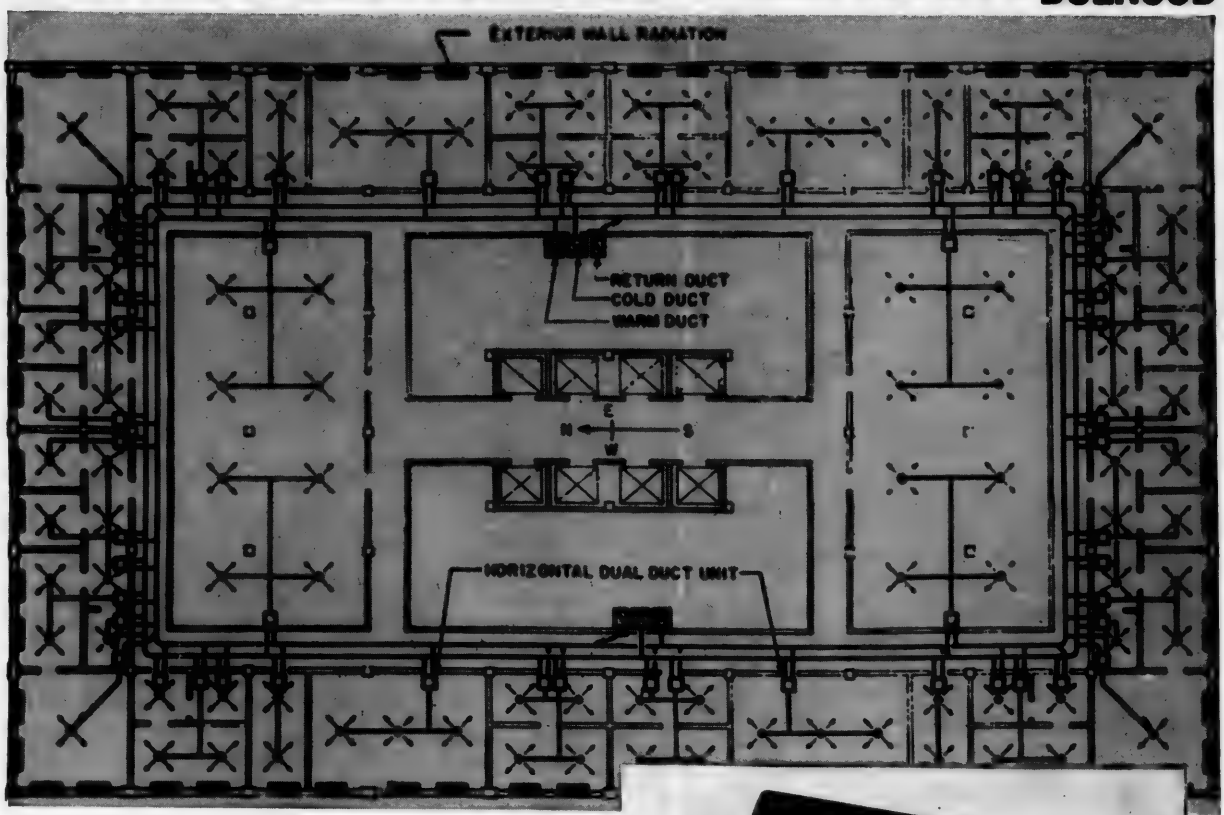
announced at I-B-R Annual Meet provides for hydronic research house, schools, technical guides.

A record budget for industry research, testing and education and the opening of a new hydronics research house were announced last month at the annual meeting of the Institute of Boiler and Radiator Manufacturers. The membership approved plans for the expansion of Institute activities designed to capture a larger share of the home heating market. Members also participated in ceremonies formally dedicating the new split-level research house.

According to I-B-R general manager Robert E. Ferry, an Institute budget in excess of $250,000, an all-time high, was approved to back I-B-R activities during 1960, including heating and cooling studies in the new research house, operation of the I-B-R test laboratory and schools, and production of technical guides and other publications for the trade.

(Continued on page 130)

NO BALANCING BOTTLENECK WITH BUENSOD



Shown above is a typical office building Dual Duct layout with individual overhead mixing units in each zone for selective temperature control. Radiation at the exterior walls prevents undesirable down drafts in cold climates and provides heat during night and weekend operation (existing buildings with radiation systems are usually treated in this manner). Changes in mixing units and zone arrangements may readily be made without disturbing the main system. When equipped with pre-set volume regulators, no balancing of units is required on the job site.

Illustrated: Buensod Type H unit designed for overhead installation, generally above hung ceilings. The unit discharges quietly and may be connected to any standard diffuser or grille. Cutaway shows self-contained volume regulator in place.

Tedious, on-the-job adjustment of volume used to be a major bottleneck in the installation of Dual Duct high velocity air systems. Now Buensod air mixing units with Automatic Volume Regulators eliminate that bottleneck. Units are balanced at the factory to specifications. Upon installation they will deliver the pre-determined air volume ±5%. For renovations of existing buildings, this feature permits zones to become operative upon installation of units. There is no need to wait until the entire job is complete.

A simple, tent-shaped apparatus is the heart of this Buensod unit. It automatically maintains constant air quantity, regardless of static pressure variance on mixing valve inlet or outlet. The volume control is completely independent of any sensing instrument, complicated linkage arrangement or outside power source.

Plan on Buensod for your next project.

BUENSOD DUAL-DUCT

Write for details to: BUENSOD-STACEY

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Scientific Frontiers

Research in Heat Storage

A method which offers considerable promise for improving the annual load factor of heat pumps and resistance heating systems is reducing electric peaks of the heating load by means of heat storage on the customers' premises. The June issue of the *Edison Electric Institute Bulletin* presents the results of preliminary investigation into heat storage materials and systems. These investigations were conducted by Battelle Memorial Institute and Comstock and Wescott, Inc., for the Joint Heat Pump Committee of the Association of Edison Illuminating Companies and Edison Electric Institute.

Battelle's report indicates that high-temperature storage, charged with resistance heating properly controlled, offers the most immediate promise as a means of smoothing load curves with either heat pump or other electric heating systems. Its second choice is condenser-side storage charged by the heat pump. Evaporator-side storage charged with "free" heat is placed third.

For high-temperature storage, the most promising media indicated in this report appear to be fused salts and refractory oxides. For condenser-side storage, the most promising material which permits the utilization of heat of fusion is indicated to be the paraffin waxes. However, the report notes that present prices for commercial waxes make their use for this purpose uneconomical. For evaporator-side storage, both the sensible heat and heat of fusion of water are suggested.

Table, which is abstracted from this report, compares the volume of selected materials needed for storing one million Btu. The volumes are for materials only and do not include provisions for associated apparatus, necessary insulation, and voids in the storage media required for heat transfer.

Comstock and Wescott's report recommends that future research and development work which might be expected to yield a practical method of heat storage be directed to the simultaneous study of three classes of systems which seem the most outstanding of the wide range of phenomena investigated, plus a study to increase the effectiveness of insulation in order to reduce its volume. It selects from each class a specific system which, for the moment, seems the most promising. In rating the merits of the various systems, the report indicates that the safety aspect and the space occupied in the house were weighted very heavily as compared with other considerations. The three classes of systems are:

Heat of Hydration Systems. This class is one which utilizes the heat generated when certain substances are combined with water. The report recommends starting with systems using calcium oxide (ordinary lime) and either liquid water or water vapor. Such systems are considered to involve little hazard, and are among the smallest and lightest of the systems studied. (Approximate volume for storage of one million Btu is 10.3 cu ft, materials only). Furthermore, regeneration may be accomplished by the use of electric resistance heating during periods suitable for a favorable load factor. The principal problem to be solved consists of preparing the calcium oxide in a physical form suitable to withstand continued regenerative cycles without deterioration.

Heat of Fusion Systems. This class is one which uses primarily the heat liberated when a suitable material changes from a liquid to a solid form. The report states that materials providing sufficient heat and occupying a sufficiently small volume require high temperatures. Report specifically recommends studying a system using sodium hydroxide. This system would be charged with resistance heating under controlled conditions of electricity supply, and would provide heat from fusion and allotropic change, as well as from sensible heat. Report indicates that this system has many advantages, among them being the relatively small space required (24.7 cu ft per million Btu, materials only), the mechanical simplicity, a minimum of development work, and an adequate safety rating if handled properly.

Heat of Chemical Change Systems. This class is one which uses the heat resulting from certain chemical reactions, such as the reaction of hydrogen with the oxygen in the air. The report indicates that the heat of this reaction can be released in a controlled way without excessively high temperatures by passing air containing a fraction of a percent of hydrogen through a catalytic reactor which causes the hydrogen to combine with a small part of the oxygen in the air with the only resultant products being heat and water vapor. It is suggested that the hydrogen be obtained through electrolysis of water or from a metal-acid reaction. The report recommends an experimental study of the hydrogen-oxygen reaction method, with particular reference to the storage of the hydrogen in the form of a metallic hydride, such as magnesium hydride. Comstock and Wescott is of the opinion that this system has great promise (9.3 cu ft per million Btu, materials only) but that storage of hydrogen in a metallic hydride is relatively new and will require extensive research. Furthermore, while the contemplated proportion of hydrogen and air in the mixture would be well within safety limits, the safety aspects of such a system would have to be carefully studied because of the inherent inflammability of hydrogen.

COMPARISON OF VOLUME OF MATERIALS NEEDED FOR STORING, IN STORAGE SYSTEMS SELECTED BY BATTELLE MEMORIAL INSTITUTE

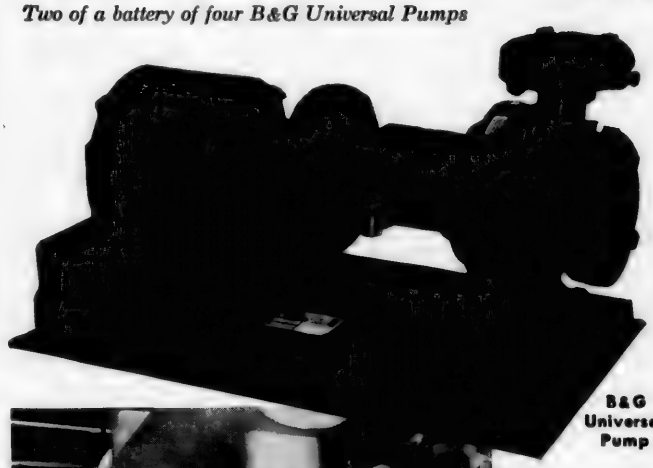
Storage System and Materials Considered Most Suitable	Useful Temperature Range, deg F	Approximate Material Volume Cu Ft per Million Btu
Evaporator-side System		
Ice/Water	15-70	84
Condenser-side System		
Water	100-130	530
Paraffin waxes	100-130	210
High-temperature System		
Water	110-300	84
Ceramic Oxides (Magnesium Oxide)	110-800	26
Fused Salts (Sodium Nitrate)	110-800	20

UNIVERSITY OF WASHINGTON
LANDER HALL—MEN'S DORMITORY

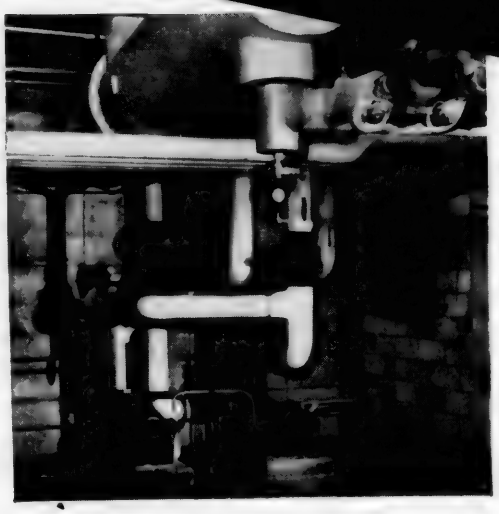
Architect: Young, Richardson & Carlton
Engineer: Bouillon, Griffith and Christofferson
General Contractor: John H. Sellen Construction Co.
Mechanical Contractor: L. G. Massart Co.

Two of a battery of four B&G Universal Pumps

B&G UNIVERSAL PUMPS SELECTED FOR DORMITORIES WHERE QUIET IS ESSENTIAL



B&G Universal Pump



Remaining two B&G Universals; above them is a B&G Type "SU" Heat Exchanger.

In buildings where students both study and sleep, *quiet* is needed to derive the greatest benefit from both. That is why B&G Universal Pumps are often selected by mechanical engineers for college dormitories where they circulate forced hot water heating systems without vibration or noise which could be created by improperly selected pumps.

For institutional, commercial or residential jobs, B&G Booster and Universal Pumps are engineered and built for just one purpose: to meet the exacting demands of water heating and cooling systems dependably, smoothly, *quietly*. They are built with such features as special, more costly motors, tested for silent running...oversized shafts of hardened steel alloy...long sleeve bearings...noise dampening spring couplers...oil lubrication and leak-proof "Remite" mechanical seals.

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These Carrier Automatic Absorption machines, largest units of their type, use heat energy to obtain chilling... operate from the same gas-fired boilers which heat the airport in winter.

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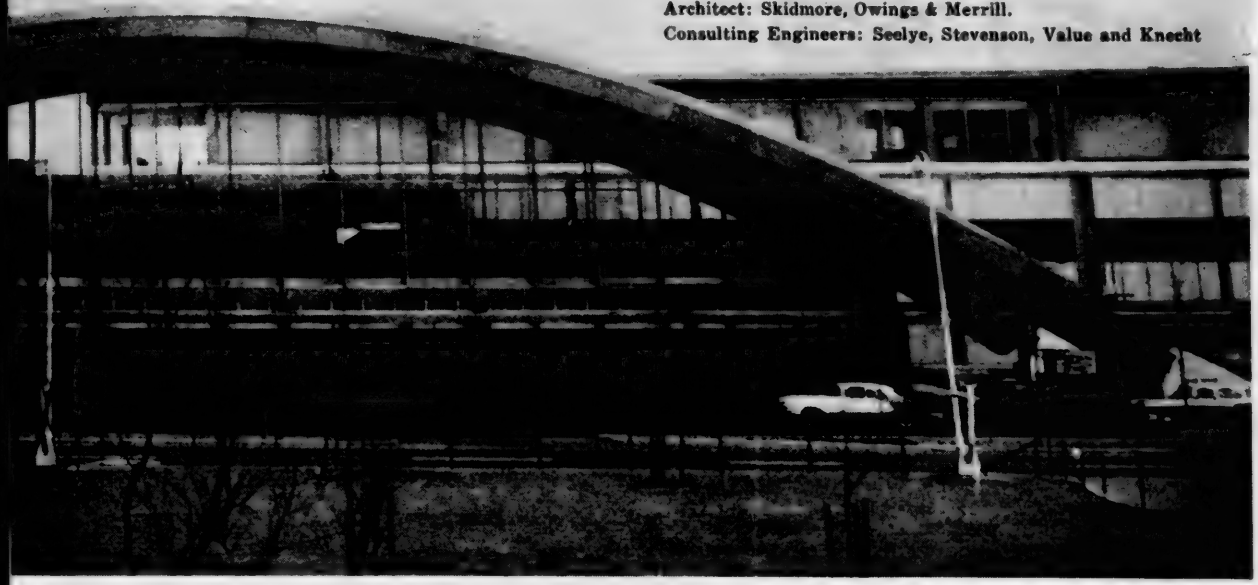
Carrier Absorption Refrigeration

Constructed by: The Port of New York Authority
Architect: Skidmore, Owings & Merrill.
Consulting Engineers: Seelye, Stevenson, Value and Knecht



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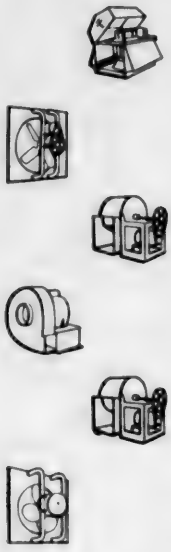

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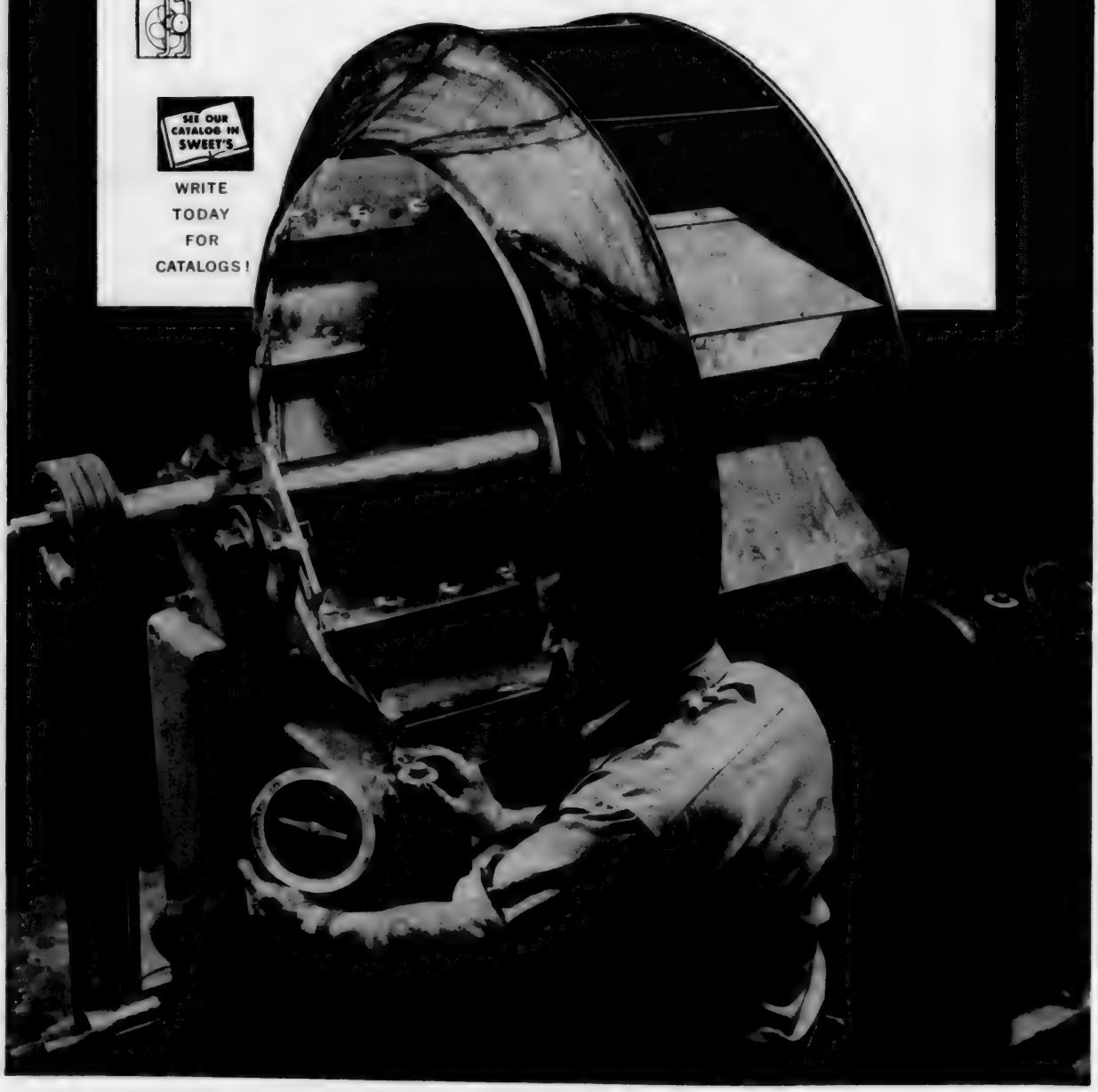

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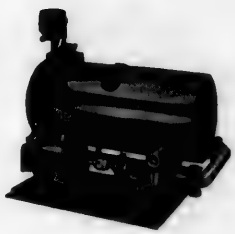
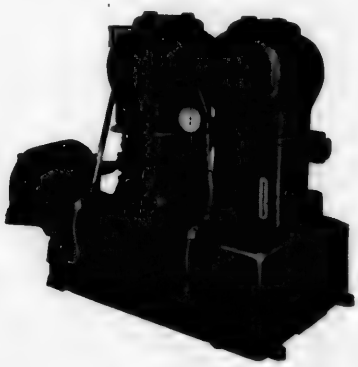


"HS" TYPE



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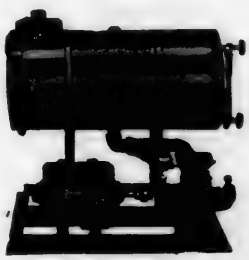

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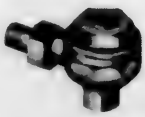
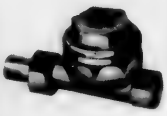


ANGLE PATTERN



STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN

RIGHT HAND CORNER PATTERN

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A CALL TO YOUR LOCAL STEEL DISTRIBUTOR ENDS IN-PLANT SHORTAGES FAST!

Emergency? Your steel service center can end it in a hurry with practically any amount, quality, size or shape of steel you may need. No more in-plant steel shortages—no more plant shutdowns—no more lost contracts.

Or you may choose to use his facilities, stocks and fast delivery service on a regular basis. Whatever your production needs, your local steel distributor is on hand ready to give instant service. All you have to do is phone.

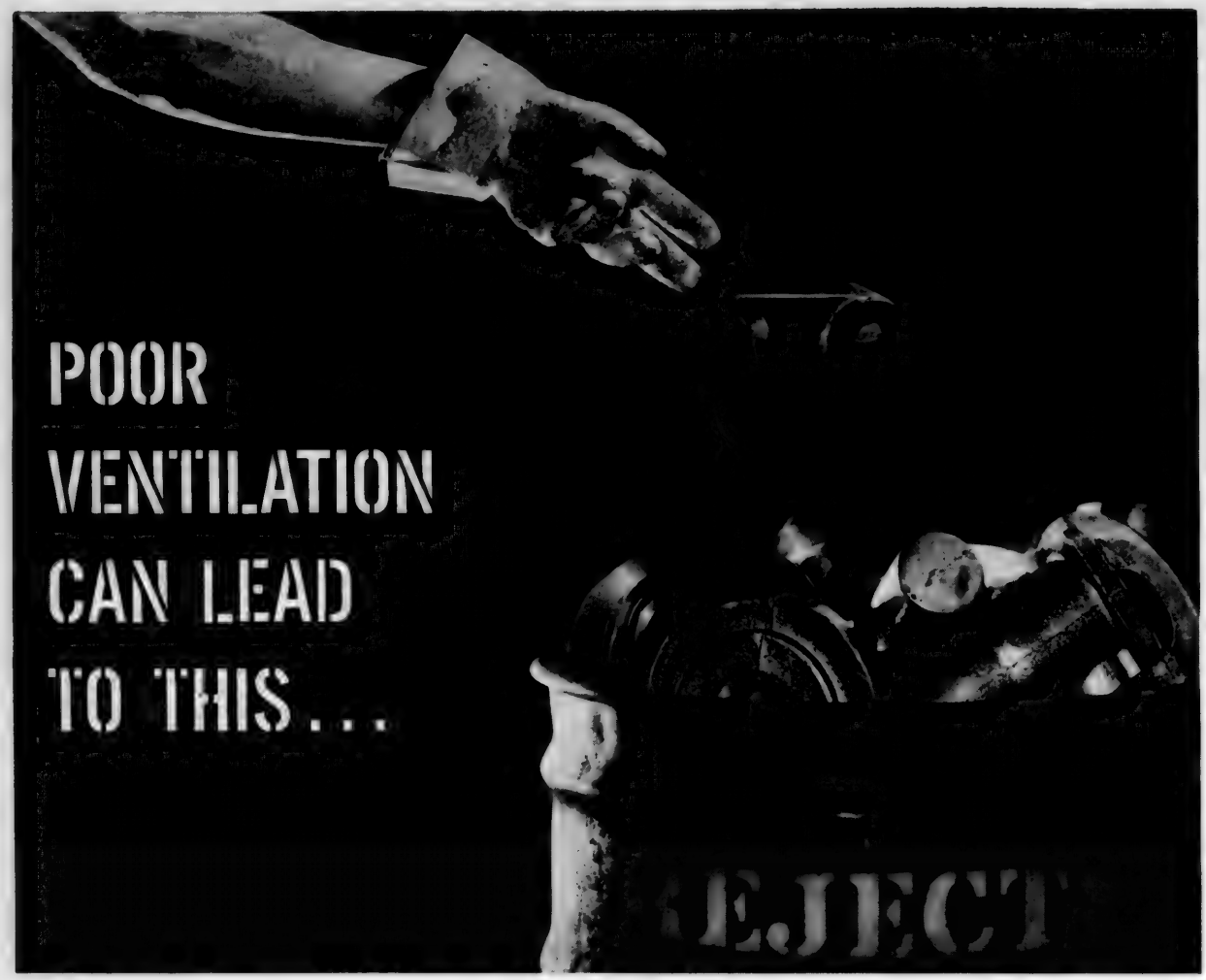
Call him for any quantity of Weirkote continuous-process zinc-coated sheets, Weirzin electrolytic zinc-coated sheets, hot- or cold-rolled sheets or any type of steel you may need for any type of production job.

WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

a division of

NATIONAL STEEL CORPORATION



Hartzell ventilation can help prevent it

Bad ventilation is bad business when it can make the difference between a 2% and a 10% reject rate. And it *can* make that much difference . . . or more. No man can consistently turn out good work when he's stifled by heat, smoke or fumes.

There's no stock answer to the problem of providing proper ventilation for industrial buildings. But no matter what your specific problem, whether it's in the operation of an existing plant or the design of a new one, you can bet that Hartzell's complete line includes the fan, blower or ventilator that's right for your job.

Your nearby Hartzell representative will be happy to supply complete information. If you don't know him, drop us a line for his name and address.

here's a complete line of air moving equipment designed and built specifically for industry

Other famous Hartzell products include controllable and full feathering propellers for light aircraft, crop drying equipment and farm ventilating fans.

HARTZELL PROPELLER FAN COMPANY • 55 Thomas Blvd. Piqua, Ohio
Div. of Castle Hills Corp. A Member of AMCA Engineering Offices in Principal Cities

NEW DATA

on operating and safety controls for jobs involving liquid level or liquid flow

This new book shows how McDonnell float-operated switches and valves, and flow switches, can be used to provide dependable, economical control for a wide variety of applications.

On hydro-pneumatic tanks, for example, or water chillers; with stand-by pumps and surge tanks; in water supply and proportioning systems. All in all there are 21 case studies in this book . . . and each one can suggest dozens of other specific applications.

These are the standard time-tested McDonnell products that heating men know so well, starring here in roles that may not be so familiar to you. To bring yourself up-to-date — to learn a lot of answers to a lot of frequently-encountered liquid level and flow control problems — get your free copy of this new Bulletin ERS-A.

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

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to get your copy of this 24-page engineering reference bulletin

Send me a copy of your new Bulletin ERS-A:
"Special Applications of McDonnell Products"

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Mail to: McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

Quick selection from TACO's New LP Series gives you the Specific Centrifugal Pump you need to get Required Performance!

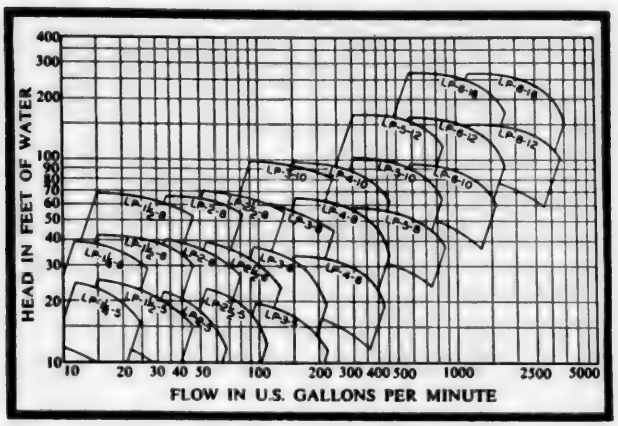
Now you can buy a centrifugal pump with almost the precise horsepower you need to get the pump performance you want! With exactness never before possible, the Taco LP centrifugal pump line design makes selection fast and easy.

For even further accuracy and economy you have these options!

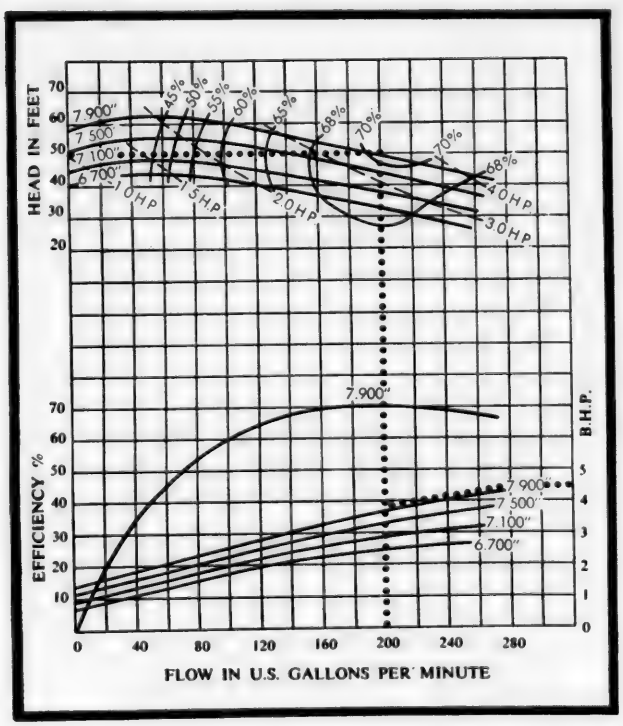
- Choose close-coupled or base-mounted models.
- Choose factory or field installation of water-cooling jackets.
- Choose sleeve or ball-bearing frames on base-mounted types.
- Choose mechanical seals or stuffing box.
- Choose the exact type of motor characteristics you want, including "extra-quiet".
- Choose stainless steel or carbon steel motor shafts, with or without stainless steel sleeves.

Fewest pump units for broadest performance range! Taco's carefully preplanned pump design has resulted in a minimum of centrifugal pump units to cover the broadest range of head and flow performances at optimum efficiencies!

Taco quick selection charts make it easy! Yes, this easy! Take a specific example where the requirement calls for pumping 200 GPM against a 50′ head, with a design specification of a 1750 RPM motor. In seconds, Taco's 1750 RPM Quick Selection Chart below (3450 chart available, not illustrated) tells you that the Taco LP 3-8 is your pump.



Getting horsepower and efficiency data is just as easy! Just follow the dotted line on this LP 3-8 Performance Curve. Note that you'll need a 7.900″ impeller, the BHP input is 3.7 and following the dotted line, the BHP at maximum flow is 4.4 (requiring a 5 H.P. motor) and the efficiency is 70%.

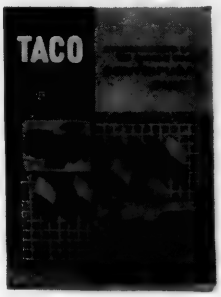


All Taco LP Pumps are tested and rated in accordance with the procedures of the Hydraulic Institute of which Taco is a member.

To cut inventory and maintenance costs LP pump parts are standardized! All LP's have ASA flanged connections; dynamically balanced impellers with double wear rings and rotatable center line discharge casings for automatic venting. Standardization of parts is welcome news to all cost conscious pump users.

New LP pump catalog, with quick selection charts available now!

You will find this new catalog to be complete, extremely helpful. In addition to quick-selection charts and performance curves, it gives complete details about Taco LP's . . . the most flexible line of centrifugal pumps ever offered hydronic engineers! Write for your copy today!



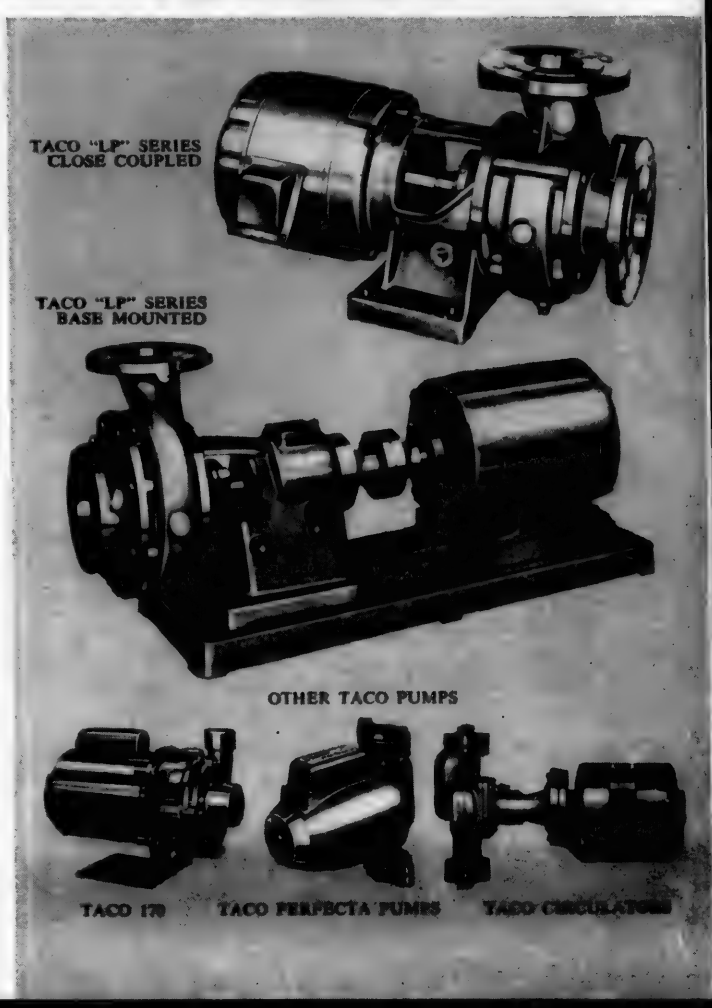
TACO

HEATERS INCORPORATED

1160 Cranston Street Cranston 9, Rhode Island

Taco

Serving the Hydronic Industry Since 1920



Underground Heat Distribution Systems

How To Protect A System Against Failure

Specifications are the *only* way a designing mechanical engineer can be assured the final project will have met his required standards and be of the quality the owner bought.

Three major elements make up an underground heat distribution system: an inner pipe to convey steam, high temperature hot water, chilled water, condensate, etc., (type and size depending upon project requirements); the insulating of the inner pipe to minimize heat loss; and the outer casing to protect the insulation and inner pipe.

The outer casing has to be specified in such a way that it will provide positive protection against moisture entrance and accumulation. Saturated

Testing welded joints by applying a soap solution with the casing under 25 p.s.i.g.

insulation, of course, equals low efficiency. Moisture, present constantly in buried pipe, accelerates corrosive action which is amplified in acidic and electrolytic soils.

To be positively leak tight the casing must be tested air tight. The engineer should specify a 25 p.s.i.g. air test on the casting for two consecutive hours without a drop in pressure.

In order to prevent accumulation of moisture, the casing should be specified with a smooth interior.

Impact from above and earth back fill weight is a problem the engineer resolves by specifying a 14 gauge steel casing with a spiral lockseam for added crush resistance.

Now knowing that his casing is impact and water proof he protects the casing by specifying an anti-corrosive compound that will withstand a 15,000 volt spark test and have a permeability of .05 perms or less.

With the casing and joints sealed leak tight and protected against electrolysis and sub-soil acids he needs only one bit of . . .

Final Protection

Any system should be selected with this thought in mind:

"That some moisture will find a way into the system such as a rain storm prior to installation."

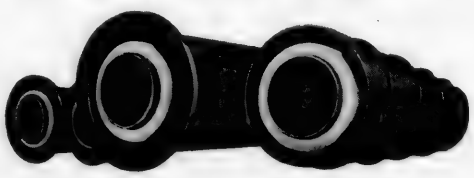
Therefore, to protect the system against any moisture that may get inside prior to final assembly, he specifies "that an annular uninterrupted air space must run the entire length of the system." With this feature and openings at ends of casing for draining and venting, he can force ventilate the system and dry it out. By necessity, the insulation must, of course, have an insoluble binder and be capable of returning to its original insulating efficiency when dry, even after a thorough saturation.

For a free 24 page catalog with facts and figures for designing and specifying underground heat distribution systems, write: E. B. Kaiser Co., 2114 W. Lake Ave., P. O. Box 47, Glenview, Illinois.

". . . for highest quality"

EBKO

PIPING SYSTEMS



NEW "BUFFALO" AIR-COOLED CONDENSERS OFFER TROUBLE-FREE OPERATION

Troubles common to most air-cooled condensers are positively eliminated by these field-tested new "Buffalo" units.

"Buffalo" Air-Cooled Condensers are a sound engineering choice for your "problem" air conditioning installations. They are ideal for overcoming such conditions as weight and erection difficulties—high maintenance costs —winter freezing troubles—winter head pressure problems — water shortages — contaminated water — high water cost—high sewer tax—poor drainage.

"Buffalo" Air-Cooled Condensers offer these and many more advantages for air conditioning applications. For full details, call your nearby "Buffalo" engineering representative. Or write us direct.

Easy-to-Install! Shipped as factory-assembled "packages." Lifting eyebolts simplify rigging.

Trouble-Free Operation! Service calls are practically nil, thanks to quality construction and unique control design.

Capacities: 7½ to 100 tons based on 120° condensing temperature, 40° suction, 100° ambient.

Vertical Discharge is unaffected by wind velocity. Holds compressor on line.

Opposed Blade By-Pass Damper Control provides close modulating control not possible with parallel-blade dampers...or with "flooded coil control." Also saves expensive Freon.

Low Silhouette! The No. 1000 unit is only 76" high.

Unit Casings! Heavy-gauge galvanized steel construction for durable long life.

BUFFALO FORGE COMPANY Buffalo, New York

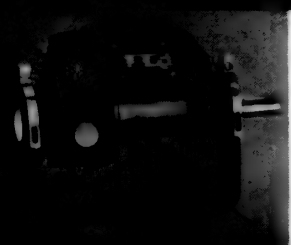
Buffalo Pumps Division, Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

Here Service Counts...



For service that counts, call, wire or write Dept. M377 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

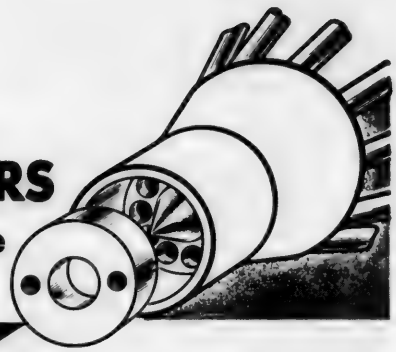
EMERSON-ELECTRIC

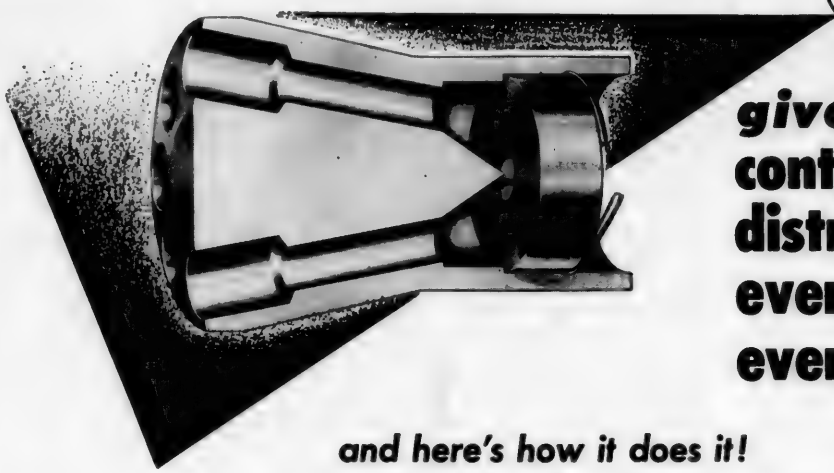
of St. Louis · Since 1890

Sporlan

REFRIGERANT DISTRIBUTORS

with the Versatile Interchangeable Nozzle

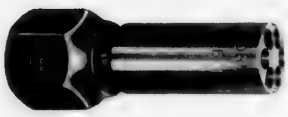


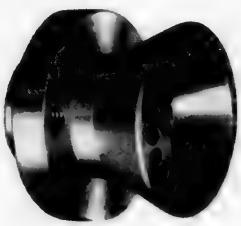


give controlled distribution *to* every circuit... every time!

and here's how it does it!

The velocity of the liquid-vapor mixture of the refrigerant is increased by the flow through the nozzle orifice. Also the turbulence created by the pressure drop causes a homogenous mixture of the liquid and vapor. This refrigerant mixture, while still at high velocity, is then immediately deflected by the conical button and fed equally to each circuit.





in addition ... the versatile interchangeable nozzle affords custom selection for any refrigerant or capacity. Coils can be stocked with distributors already attached and proper capacity nozzles can be selected either before delivery or on the job.

The removable nozzle simplifies visual, air, or test wire inspection at coil and distributor connections. Final coil and distributor leak test made easy prior to valve installation.

Get controlled distribution to every circuit, every time ... buy Sporlan Refrigerant Distributors with the Versatile Interchangeable Nozzle for Peak Performance on all direct expansion multi-circuit evaporators, regardless of load or temperature. Better still, buy Sporlan Right Down the Line and get Peak Performance throughout!

See your Sporlan Wholesaler today... and be sure to ask him for Bulletin 20-10.

Our 25th Anniversary
1934...1959

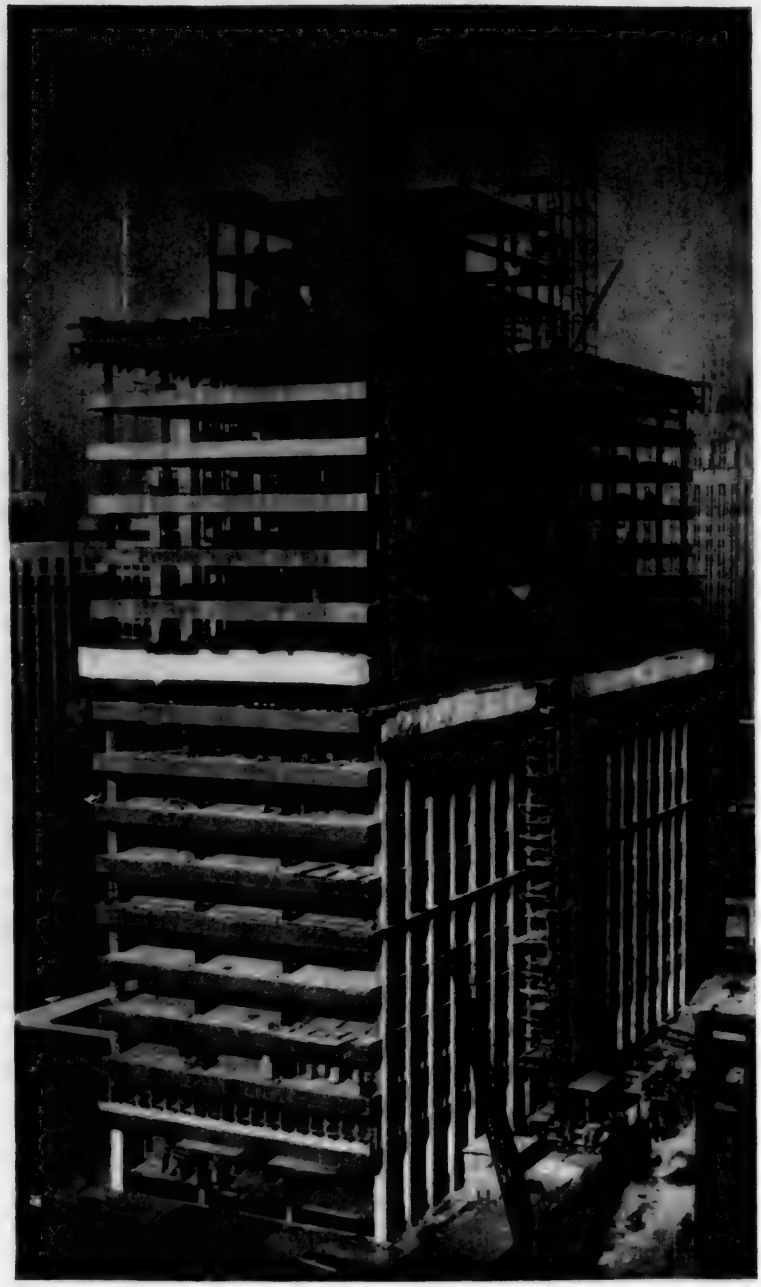
SPORLAN VALVE COMPANY
7525 SUSSEX AVE. ST. LOUIS 17, MO.

EXPORT DEPT. 85 BROAD ST. NEW YORK 4, N.Y.

Bethlehem Steel Pipe works easily, installs fast. Beth-Co-Weld is furnished, black or galvanized, in sizes from ½ to 4 in., nominal, and in uniform 21-ft lengths, ± 1-in., and in random or cut lengths. We produce larger diameters as Electric Resistance-Weld Steel Pipe.

BETH-CO-WELD in BOSTON

Long-Term Steel Pipe Service for New Travelers Insurance Building



THE Travelers people practice what they preach. Their new 16-story office building is well protected against fire by a network of sprinkler and fire lines. But this is their *real* insurance: the lines are fabricated from Beth-Co-Weld and Bethlehem Electric Resistance-Weld Steel Pipe.

Vent and drain lines, too, are steel pipe made by Bethlehem—some galvanized and furnished in extra-long 23-ft, 2-in. lengths which, cut in half, run the full 11-ft, 7-in. story height. Travelers found true economy in Bethlehem Steel Pipe.

In any building, durable, low-cost steel pipe is a sound choice. On your next job, use Beth-Co-Weld and Bethlehem Electric Resistance-Weld—Steel Pipe at its best.

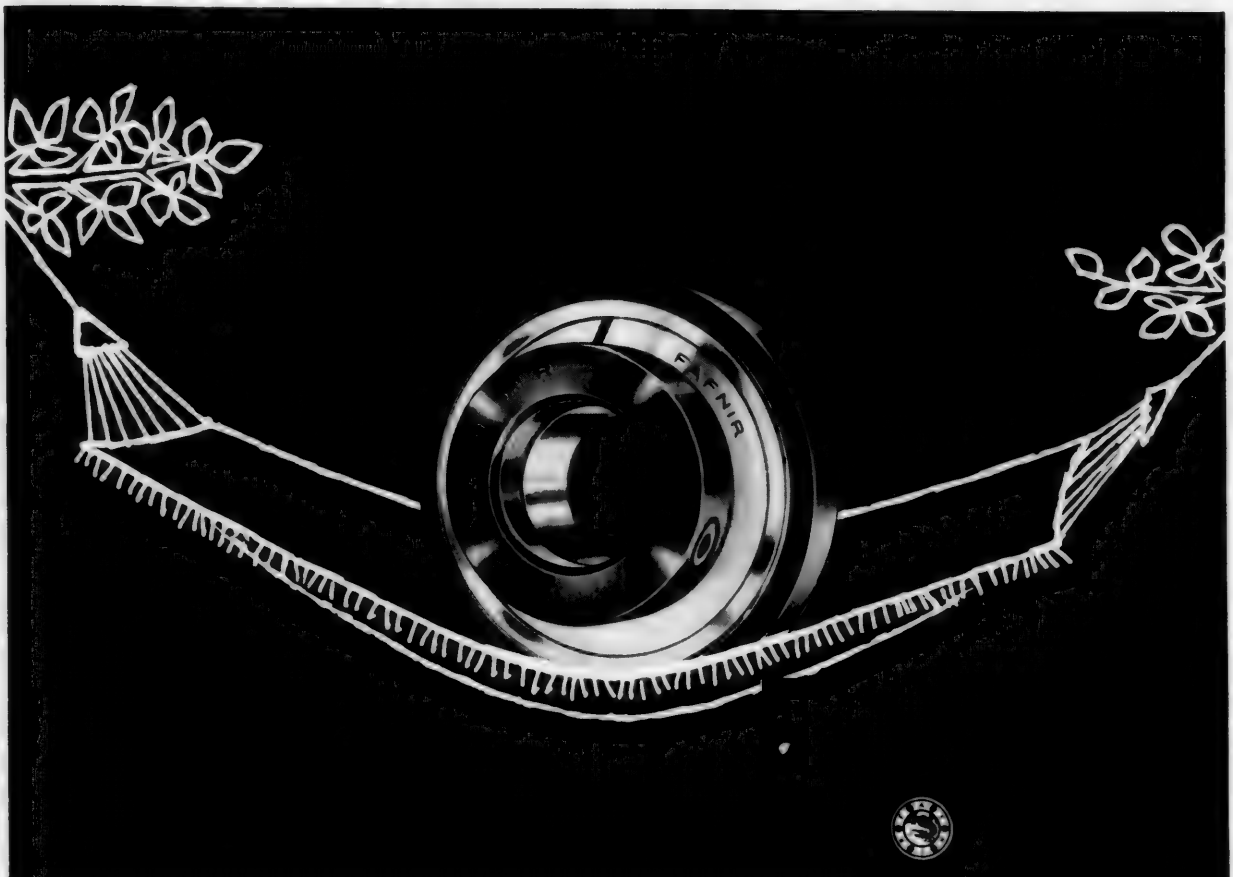
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

Export Distributor:
Bethlehem Steel Export Corporation

Architect: Kahn & Jacobs, New York. *General Contractor:* George A. Fuller, Boston. *Plumbing Contractor:* Crane Plumbing and Heating Co., Cambridge, Mass. *Pipe Jobber:* Charles D. Sheehy, Inc., South Boston.

BETHLEHEM STEEL

BETHLEHEM STEEL



even the bearings are built for "comfort" in Fafnir-equipped Westinghouse Comfort Command Air Conditioners

When Westinghouse designed the versatile Comfort Command Air Conditioner, they built it for cool, quiet, trouble-free comfort right down to the blower wheel bearings! ✓ ✓ ✓ Fafnir Super-Quiet Ball Bearings on the blower shaft feature balls and races specially polished for noiseless service. Fafnir-developed current-conducting rubber grommets absorb vibrations ... eliminate the need for grounding clips or springs. ✓ ✓ ✓ Bearing maintenance is practically nil. Relubrication is never needed. Plya-Seals, contact type, lock in factory-packed lubricant, and protect against contaminants. ✓ ✓ ✓ Investigate Fafnir's wide selection of ball bearings and ball bearing units for heating and air conditioning equipment. Chances are, you'll find types and sizes that fit your needs precisely. Write for bulletin today to The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR SUPER-QUIET BALL BEARINGS on blower shaft assure silent, power-saving, maintenance-free service. Available with or without rubber grommets, and in rubber cartridges or pressed steel, rubber interlined pillow blocks.

WESTINGHOUSE COMFORT COMMAND offers customized home cooling. Combines with any hot air system for year-round, automatically-controlled indoor comfort. Economical air-cooled condensing unit (illustrated) permits outdoor installation, with add-on cooling coil unit for interior duct installation.

When you compare copper fittings...

remember David and Goliath!

ACTUAL BURST TEST of installed 1/2" NIBCO wrot copper tee shows that the tubing burst at 3760 p. s. i., and that NIBCO wrot fittings are stronger than the tube they join — an extra margin of safety that far exceeds pressure demands of liquids or gases in a copper system.
ZONE OF STRENGTH

Like David of old, NIBCO wrot copper fittings are strong where it counts. Wall thicknesses in the NIBCO "zone of strength" (as shown in the cutaway tee, for example) are not made to the "L" minimum ASA standard, but have heavier than "K" wall thickness of metal... additionally densified in processing. This is but one reason why NIBCO fittings are specified by the nation's leading contractors and service organizations. See your NIBCO wholesaler, or send coupon for ***FREE CATALOG.***

NIBCO

NIBCO INC.—Dept. J-6308 Elkhart, Indiana

Please send "Catalog I" of NIBCO fittings.

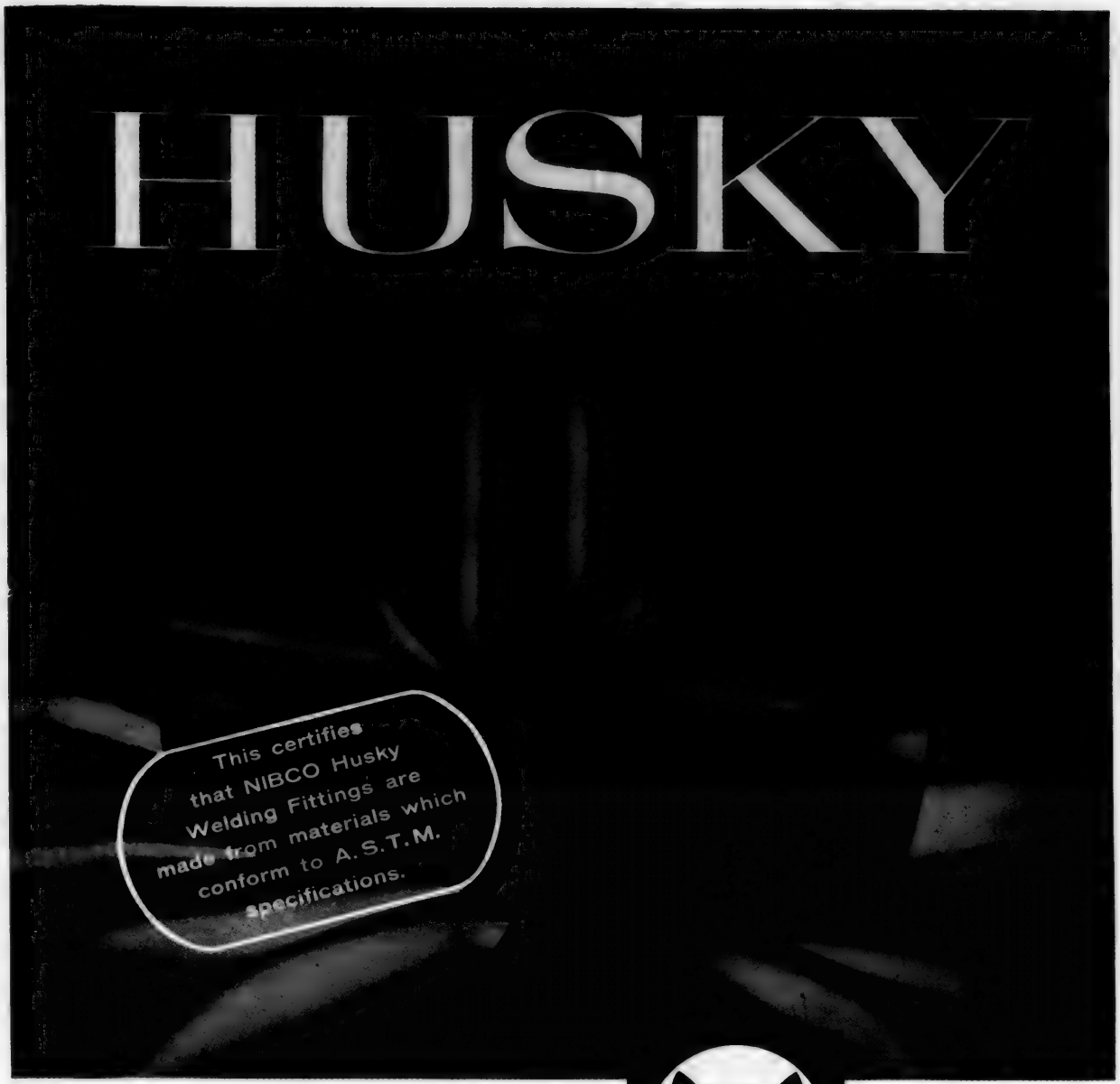
name

firm

address

city, state

HUSKY



Husky fittings conform in all respects to the following high standards set forth by the American Society For Testing Materials: A 234-58T.

- ✓ PROCESS AND MATERIAL
- ✓ TENSILE PROPERTIES
- ✓ MANUFACTURE
- ✓ HARDNESS
- ✓ CHEMICAL COMPOSITION
- ✓ WORKMANSHIP AND FINISH
- ✓ HEAT TREATMENT
- ✓ MARKING
- ✓ INSPECTION

Learn why Husky fittings are "7 Ways Better" . . . send coupon.

tees | reducing tees | 90° elbows | 45° elbows | reducers

HUSKY
WELDING FITTINGS

SEND FOR CATALOG OF HUSKY STEEL WELDING FITTINGS

NIBCO INC., DEPT. J-6308, Elkhart, Indiana

Please send your new Husky Catalog H-1 without cost or obligation.

name

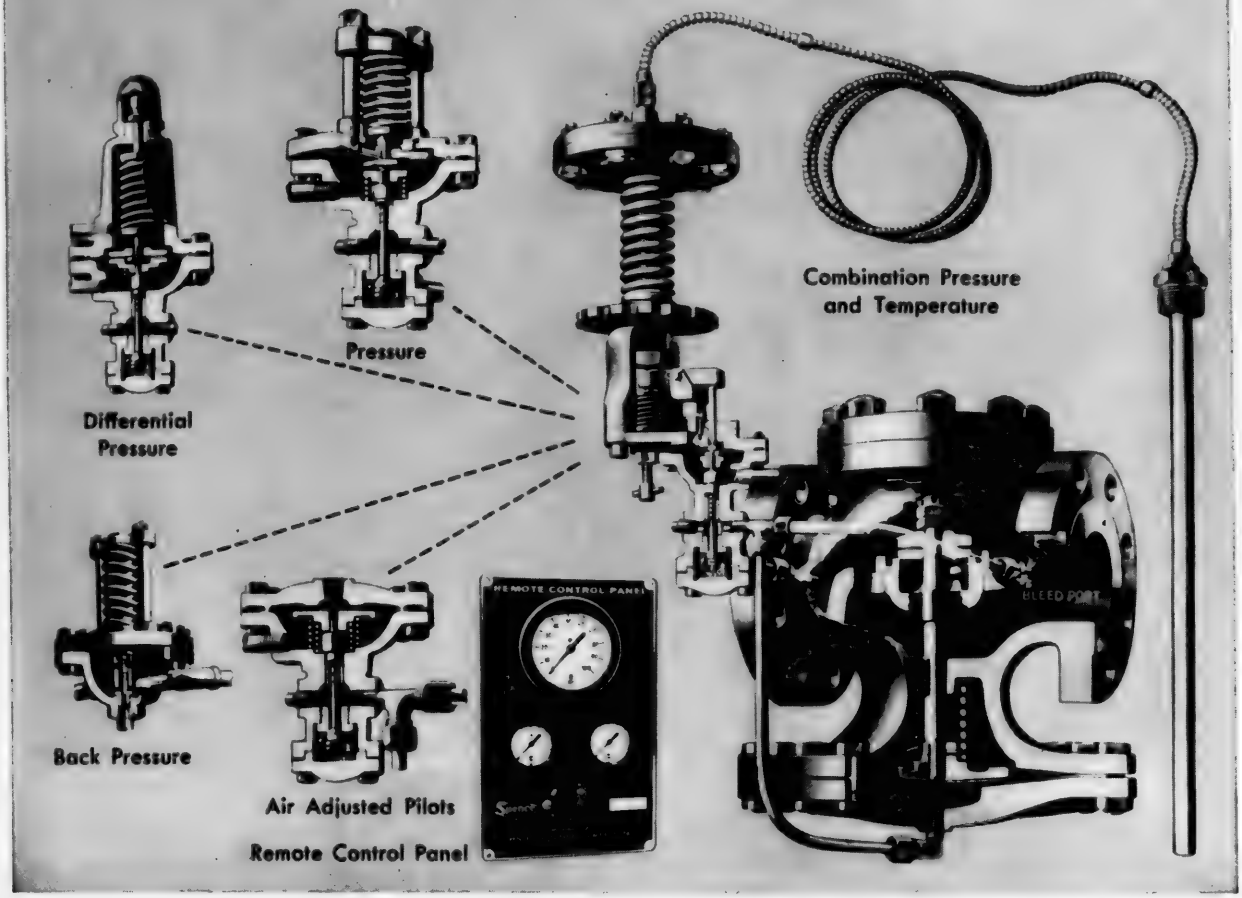
firm

address

city, state

☐ Please also send address of nearest supplier.

All Pilots Fit All Main Valve Sizes Downtime, Maintenance, Inventory Reduced



Let's start off by admitting there's no such thing as a "maintenance-free" regulating valve. Any valve that automatically controls temperatures or pressures within close limits can be affected by dirt in steam lines.

If trouble does develop, engineers want a regulator they can get back on the line — fast. That's one reason why more engineers are standardizing on Spence Regulating Valves with externally mounted pilots. The simple test of disconnecting the external bends establishes whether the trouble is in the main valve or the pilot.

If the main valve is the trouble spot, it can be maintained without removing the valve body from the line. If the pilot is the trouble spot, it is easily removed for cleaning. However, if production downtime is a strong factor, the fastest method is to install a spare pilot and it is inexpensive.

All Spence pilots fit all sizes of Spence main valves. If you have twenty pressure regulators, for instance, all you need is *one spare pilot*. It will fit all main valve sizes from ¼" to 12".

Another advantage of the Spence design is the external pilot is interchangeable. You can change the function of a regulator by merely changing the pilot. In many plants this can represent an important factor in reduced inventory costs because you only carry a few inexpensive extra pilots instead of complete regulators. Obviously, there is also a considerable savings in labor costs when a valve can be converted, in the line, from a temperature regulator to any one of various pressure regulators.

The pictures above show a few of Spence's wide line of automatic regulators. For more information write for Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York 58-148

DUNHAM-BUSH EQUIPMENT...

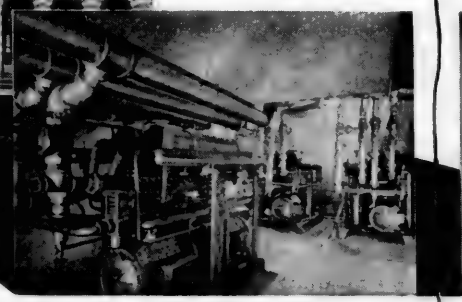
threads
* interlocking
temperature-
humidity
system

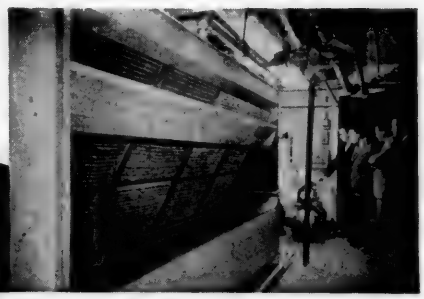
AMERICAN THREAD COMPANY
New York 7, New York

CONTRACTOR
Park West Air Conditioning, Division of M. Kraus, Inc.

WHOLESALER
Wholesale Distributors, Inc.

PLANT ENGINEER
E. L. Bunch





*** 45 TON LOAD IS HANDLED BY THREE 15 TON HEAT-X PACKAGE CHILLERS. EACH CHILLER IS EQUIPPED WITH TWO 7½ TON BRUNNER-METICS TO CONDITION ANY OR ALL OF THREE ZONES.**

The Plant Engineer and others concerned with American Thread Company's air conditioning, in effect wore "three hats".

They wore the "hat" of an efficiency expert in installing a system that can be inter-changed to condition any or all of three zones.

They wore the "hat" of an insurance counsellor in providing an inter-locked system that will continue to function and localizes possible failure points.

They wore the "hat" of a shrewd purchasing agent in selecting all Dunham-Bush equipment for the system (Heat-X Package Chillers... Air Handling Units... Indoor Tower... and Air Compressors by Brunner Division).

Whether you're planning a new air conditioning system or bringing your present system up to date, pose your problem to your Dunham-Bush sales engineer. He can give you advice that lets you wear "three hats" as well as your own.

Write for free information on Dunham-Bush air conditioning, heating and refrigeration installations 'round the country.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

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MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA
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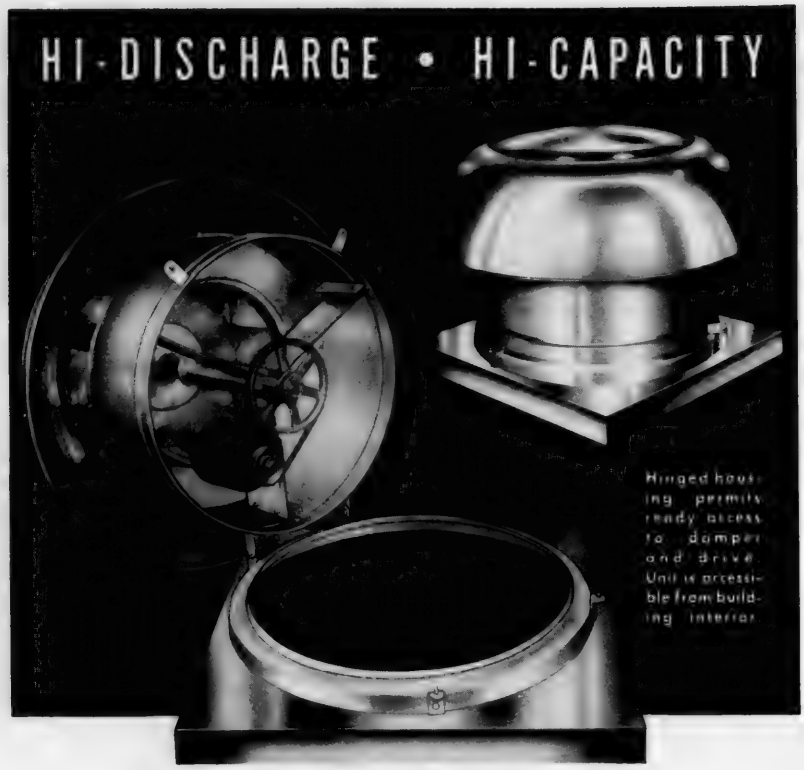

HI-DISCHARGE • HI-CAPACITY
Hinged housing permits ready access to damper and drive. Unit is accessible from building interior

...new JENN-AIR "HI-D" Power Roof Exhausters

When specifications call for an exhaust fan with BIG air moving capacity, they call for Jenn-Air's new "Hi-D" Power Exhausters. Designed in both axial and centrifugal wheel models, these belt drive units offer capacity ratings in a broad range from 480 to 28,650 cfm.

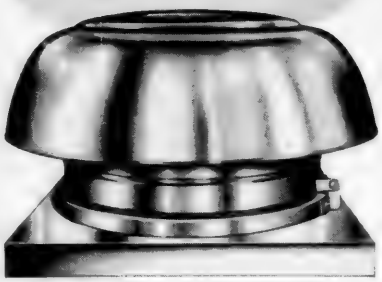
In addition to high capacity, Jenn-Air "Hi-D" Exhausters provide these important design features:

- Wheel is located above motor to combine high discharge point with an overall installed height lower than any comparably-rated exhauster.
- Non-overloading wheel, made of heavy gauge aluminum, is dynamically and statically balanced in the Jenn-Air Sound Laboratory.
- Exclusive guide vane construction improves air moving efficiency while minimizing turbulence and noise.
- Adjustable motor pulley permits speed variation.
- Totally enclosed motor and tubular drive assembly feature permanently sealed, pre-lubricated ball bearings. Motor is effectively cooled by air stream.
- Bird guard of heavy gauge stainless steel is an integral part of every unit.
- Maintenance-free aluminum housing provides strength without weight.

The HAB Series of "Hi-D" Exhausters (axial blade) gives highest air-per-dollar value in short duct runs where static pressures are negligible. The HCB Series (centrifugal wheel) effectively overcomes static pressures and is usually preferred for long duct runs. Its smaller diameter permits a corresponding reduction in duct size.

JENN-AIR

All-Aluminum LOW-CONTOUR RELIEF VENTS

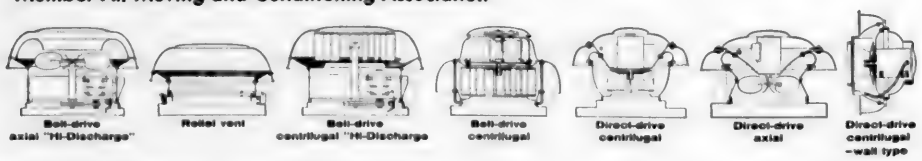


For fresh air intakes or pressure relief within buildings, specify Jenn-Air relief vents. These high-discharge units are designed in seven sizes . . . built to handle from 356 to 18,350 cubic feet per minute. Weather proof, bird proof Jenn-Air relief vents eliminate unsightly goosenecks and hoods.

Specially designed hinge on housing permits ready access to damper. Simple locking mechanism keeps unit tightly closed.

Ask your Jenn-Air representative for performance and dimensional data on the complete line of Jenn-Air Power Exhausters and Relief Vents.

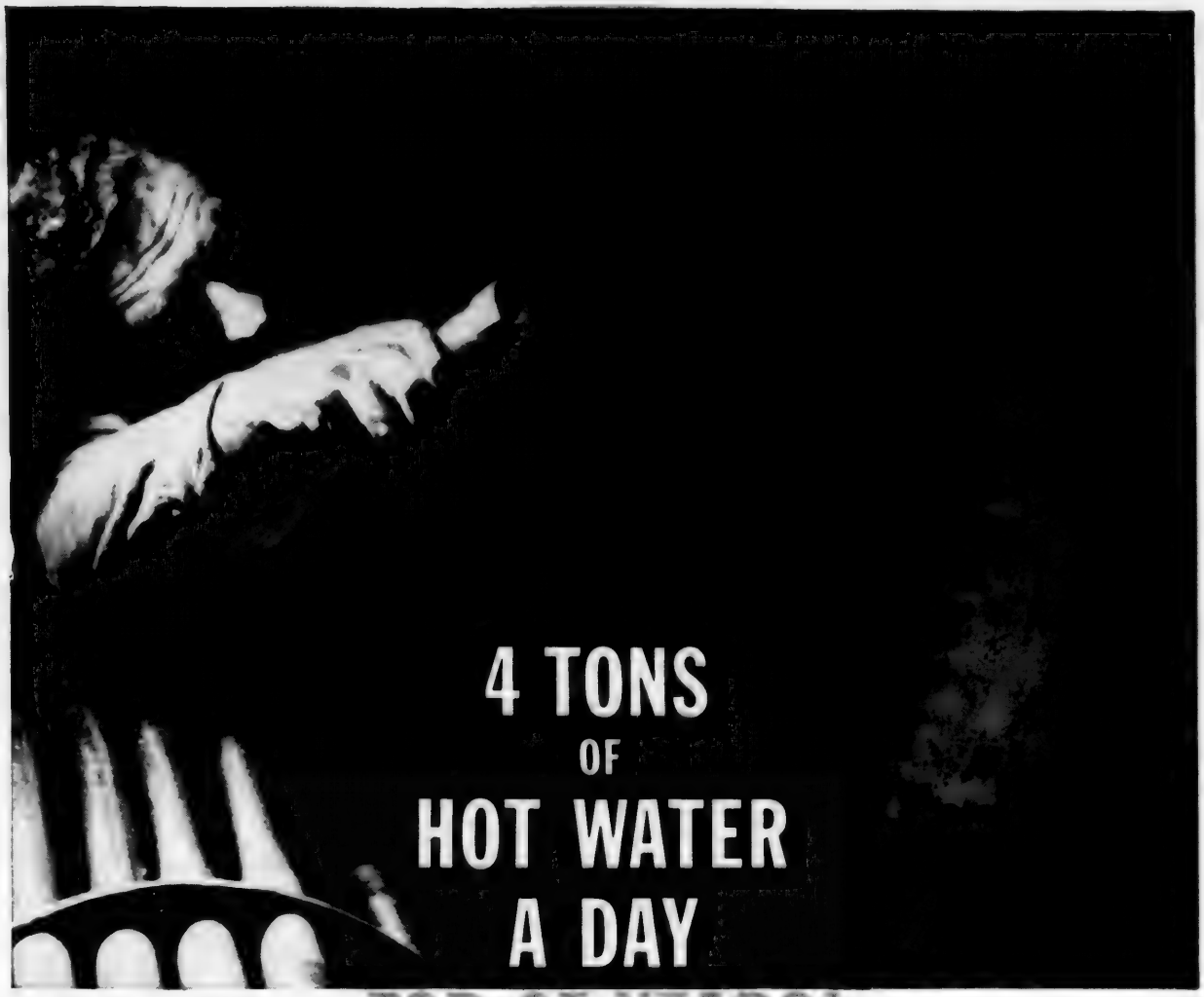
Member Air Moving and Conditioning Association



JENN-AIR

Jenn-Air Products Company, Inc. • 1102 Stadium Drive, Indianapolis 7, Indiana

R. B. Scally, stationary engineer at the Bronx (N. Y.) County Building, checks the interior of the P-K copper-lined storage water heater which has been in continuous use for 27 years. Annual inspections always show the unit to be in first-class condition.



4 TONS OF HOT WATER A DAY FOR 27 YEARS!

...that's the no-trouble service record of this P-K copper-lined storage water heater

Back in 1932 this P-K copper-lined storage heater was installed in the Bronx County Building, in New York. Since that time, it has processed 8½ million gallons of rust-free hot water at 140° F. The unit is inspected annually; "And," says John Bennett, the building's senior stationary engineer, "we always find it in excellent condition."

Why users expect—and get—maintenance-free operation from P-K's Copper-Lined Heaters

Steel shells of P-K copper-lined storage water heaters are double butt welded. All inside welds are ground flush, and the stored hot water contacts only copper or copper-silicon. Expansion joints in the lining, placed every 12", allow longitudinal expansion. All couplings and fittings are of copper-silicon. Couplings are heavy, reinforced forgings welded to both sides of the lining. Wherever they are used, P-K storage heaters are running up impressive performance records. *Patterson-Kelley Co., 1108 Warren Street, East Stroudsburg, Pa.*

4

Send for your copy of this latest P-K Data File No. 16 on Copper-Lined Storage Water Heaters

Patterson Kelley
Water Heater Division

storage water heaters • instantaneous heaters convertors • water to water exchangers

Corrosion-resistant, fireproof vents

...with eye-appeal!

Vertical exposed flues of Transite Vent Pipe form eye-catching design on new Rockwell Manufacturing Co. installation

A GLANCE at this attractive new plant tells you that the material used for the exhaust flues is vital—vital to the plant's appearance . . . vital to maintenance economy.

That's why Walter Wagner & Partners, Architects & Engineers of Fresno, Calif., chose Transite Industrial Vent Pipe to exhaust corrosive fumes from the plant's small parts casting pots.

Made of asbestos-cement, Transite® retains its good appearance through years of weather. *Saves on upkeep*, because it never needs painting or preservative coating. *Saves on maintenance*, because it resists the attack of most gases, mists, fumes, and dusts. Installed indoors or out, Transite offers you these same appearance and maintenance-free advantages.

Transite also offers many layout and installation economies. A wide variety of fittings, diameters and lengths makes it readily adaptable to every venting service. Ease of cutting and handling add further to installation savings.

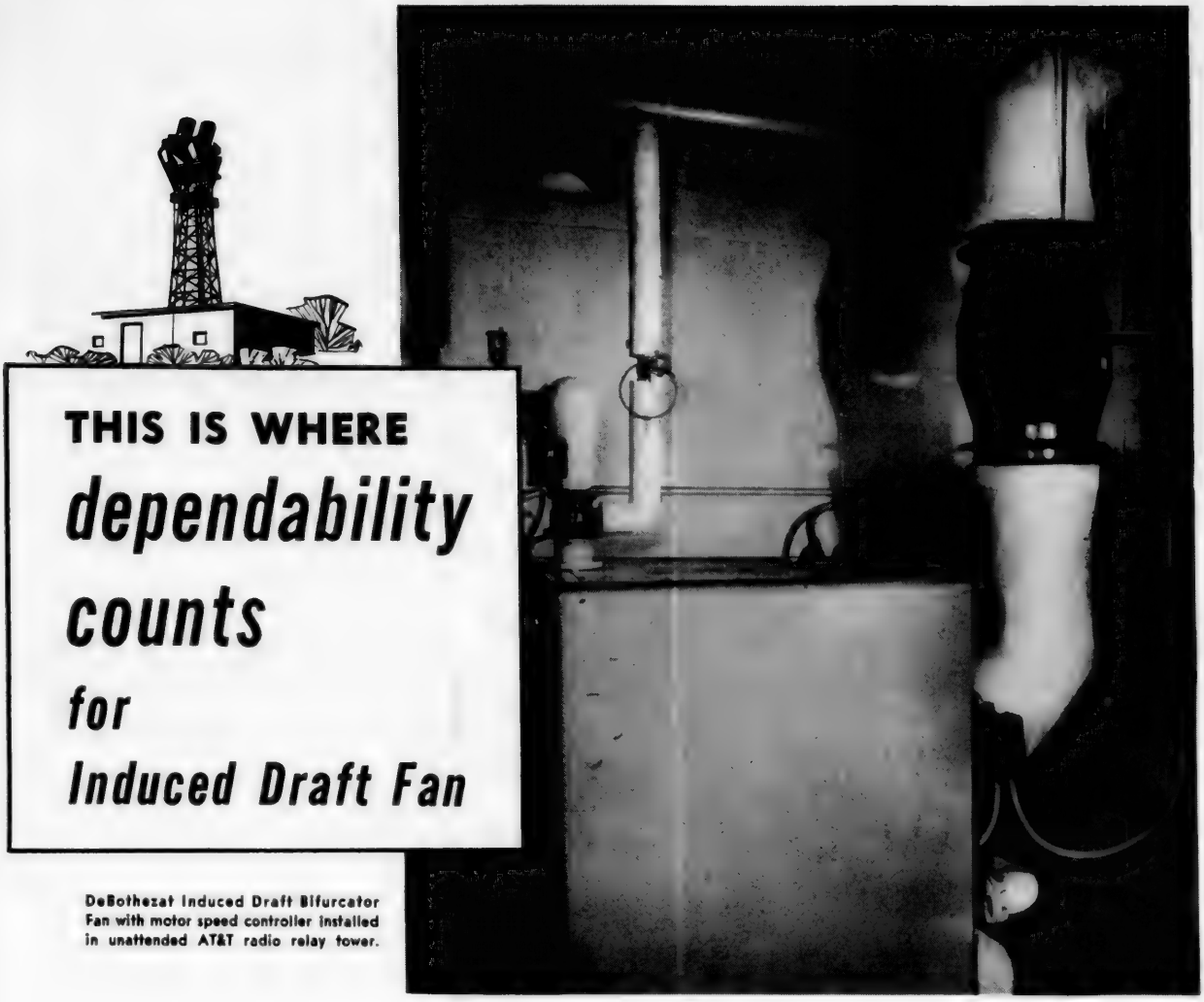
Let us send you DS-336—a 24-page brochure on Transite Industrial Vent Pipe. Write Johns-Manville, Box 14 HV New York 16, N. Y. In Canada, Port Credit, Ontario.

Architects & Engineers: Walter Wagner & Partners, Fresno, Calif.
Mechanical Contractor: Robert Wright Plumbing, Porterville, Calif.

New plant at Porterville, Calif., has twenty-two 8″ Transite exhaust flues. Joined by 14-gauge metal bands, each flue has clean, unbroken appearance.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS



THIS IS WHERE *dependability counts for Induced Draft Fan*

DeBothezat Induced Draft Bifurcator Fan with motor speed controller installed in unattended AT&T radio relay tower.

This installation of a DeBothezat Induced Draft Bifurcator® is typical of numerous others in unattended radio relay towers of the American Telephone and Telegraph Company. A dependable, controlled draft helps maintain correct temperatures that safeguard the performance of sensitive electronic equipment.

This Induced Draft Fan utilizes a direct motor drive which eliminates any chance for belt failure. The fan motor mounts in a separate insulated chamber and hot flue gases are bypassed around it.

DeBothezat Induced Draft Bifurcator Fans install just like a section of breeching or duct-work. This saves on space and installation costs.

Bifurcators can be equipped with motor speed controllers which regulate draft according to exact boiler requirements.

For more details, see our section in Sweet's Plant Engineering File . . . or write.

De Bothezat™ FANS

A DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

FOR FURTHER INFORMATION SWEET'S PLANT ENGINEERING FILE OR WRITE FOR COPY

IN CANADA: Represented by DOUGLAS ENGINEERING CO., LTD., Toronto • Montreal

FIRST! CAST IRON BOILER-BURNER UNITS FOR No. 5 OIL OR COMBINATION GAS—LIGHT OIL

These Weil-McLain units are furnished with air atomizing, pressure type burners, completely integrated with electronic controls and factory-engineered combustion chamber design. The Oil Heating Units, while primarily designed to burn low-cost No. 5 oil, will efficiently handle all grades of lighter oils. The Combination Gas—Light Oil Units will burn either gas or No. 2 fuel oil.

Heavy Oil Burners

These burners furnish all the air needed for combustion. The accurately metered oil is intimately mixed with air into a highly combustible spray in the nozzle. Burners start with a small flame which gradually builds up to proper size. Safe operation is assured by electronic control.

Combination Gas—Light Oil Burners

Units consist of a power gas burner and a high pressure air atomizing burner, with high efficiency assured by correct metering of air and fuel. For both gas and oil operation, burner starts with small flame and builds up to required size. Electronically controlled with pre-purge and post-purge... manually or automatically changed from one fuel to another. Send for Bulletin C-272.

Burner service provided for one year, including start-up

For information on other Weil-McLain Gas and Oil Boilers, see Engineers' Product File or Sweet's Architectural File.

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FOR COMMERCIAL AND INDUSTRIAL HEATING SYSTEMS

WEIL-McLAIN BOILERS RADIATORS

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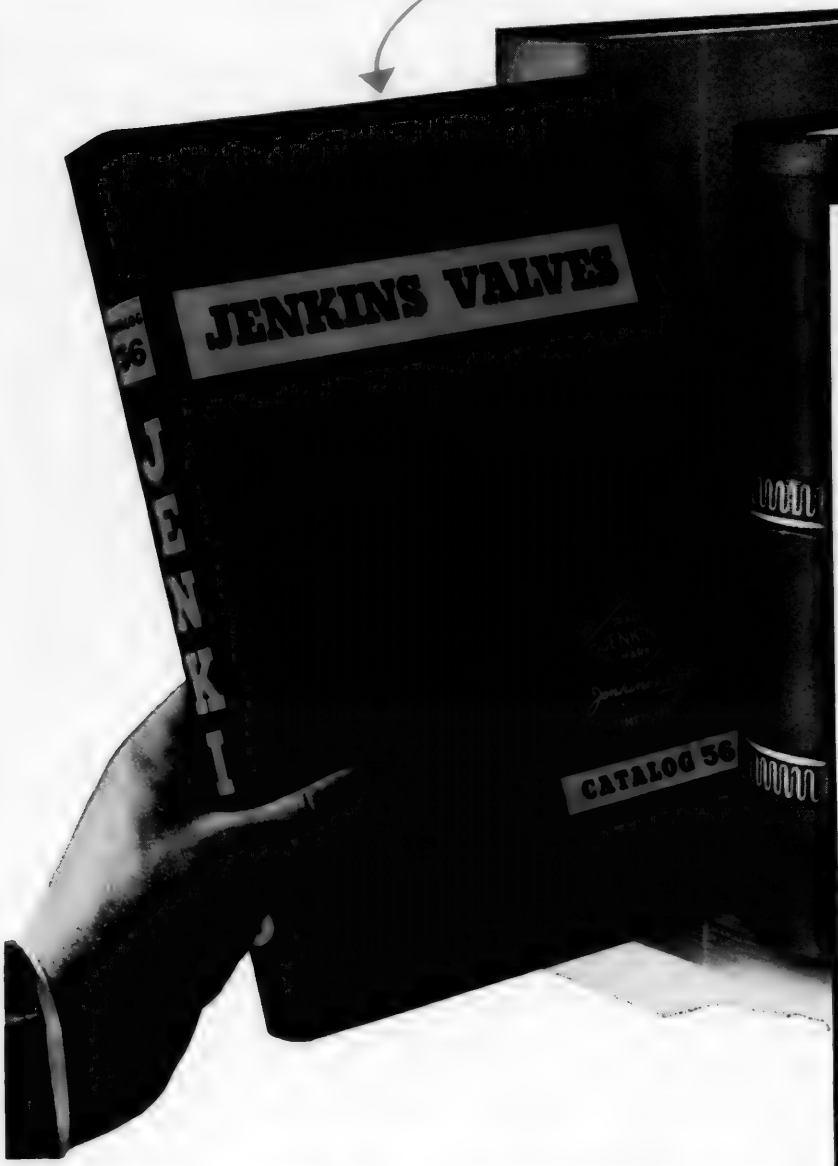
MICHIGAN CITY, INDIANA

Address literature requests to Dept. BB-89

The Valve Catalog to Reach For FIRST



For clear, complete, easy-to-find data on valves and how to select and use them, no other single book compares with this latest Jenkins Catalog

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VALVES

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Draftless Anemostat Air Diffusers at Sterling and Francine Clark Art Institute

The photograph above illustrates an Anemostat Straightline Air Diffuser installation in the gallery design of the Sterling and Francine Clark Art Institute at Williamstown, Mass. The conditioned air is supplied through Straightline Diffusers located on all four sides of the gallery. The diffusers not only draftlessly introduce conditioned air into the gallery, but also blend into the architectural design.

Anemostat, Round, Square and Straightline Diffusers for conventional or high velocity systems are adaptable to a wide variety of architectural designs.

Write for Selection Manual No. 60, which gives data on Anemostat's wide range line of air diffusion equipment.

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Why hospitals find Sarcotherm Systems ideal.

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Children's Hospital	Washington, D. C.	5
Community Hospital	Cumberland, Wisc.	4
Copiah County Hospital	Hazelhurst, Miss.	3
Delaware State Hospital	Farnhurst, Del.	11
Embreeville State Hospital	Embreeville, Pa.	53
Freeport Hospital	Freeport, L. I.	4
New Leake County Hospital	Carthage, Miss.	5
North Carolina State Hospital	Goldsboro, N. C.	4
Milledgeville State Hospital	Milledgeville, Ga.	13
Rabun County Hospital & Health Center	Clayton, Ga.	5
Rowan County Medical Center	Salisbury, N. C.	5
Springfield State Hospital	Syskeville, Md.	5
V. A. Hospital	Clarksburg, W. Va.	4
Woodville State Hospital	Woodville, Pa.	18
York County Home	York, Pa.	13

FOR COMPLETE CONTROL SYSTEM CATALOG, write Sarcotherm Controls, Inc., 635 Madison Ave., New York 22, N. Y.

Why architects, engineers, contractors find Sarcotherm Systems ideal for hospitals...

1. *Application engineering* — Sarcotherm engineers, backed by years of experience in hospital heating control systems, assist consulting engineers with individualized system diagrams.

2. *Easy to install* — drawings and diagrams of the complete system are furnished for each job.

3. *On-the-job assistance* — to contractors, from Sarcotherm's field engineers.

4. *Low installed cost* — because of simplicity; minimum of wiring and piping.

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One of the recently completed hospitals equipped with a Sarcotherm Weather-Compensated Control System for hot water heating. Installation includes 5" Sarcotherm 3-way modulating mixing valve, programmed timer, radiator valves, balancing fittings, automatic air vents and other heating specialties.

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Heating Contractor — Seaboard Installations, Inc., New York City.

4016-B

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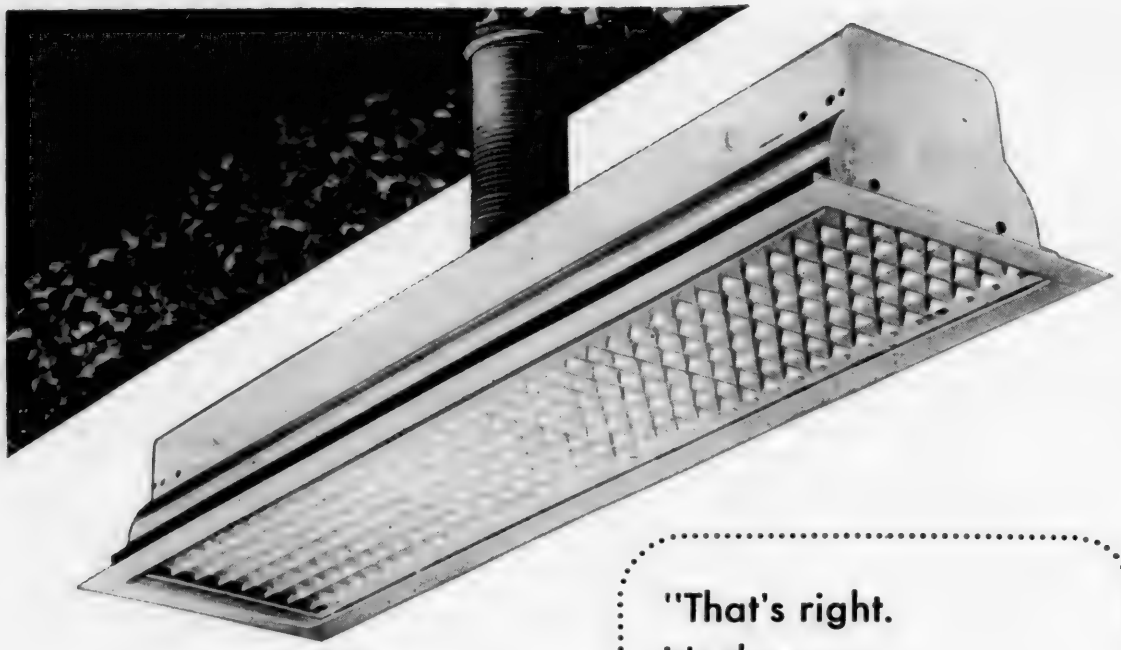
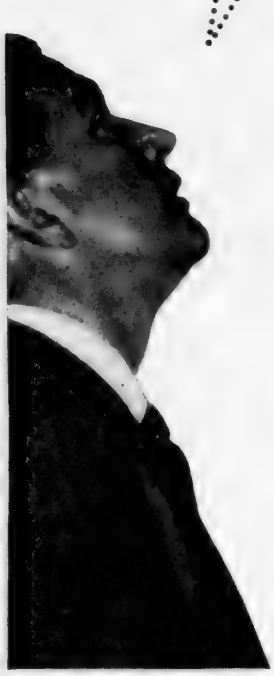
AN AFFILIATE OF SARCO CO., INC.

Weather-Compensated control systems for steam, hot water and radiant heating



"That's right.
It's the new
MULTI-VENT TROFFER
The air diffuser
is completely concealed
in the flush light fixture!"

"You mean you get
both air *and* light
from the same unit?"



There's more to the new **MULTI-VENT TROFFER** than meets the eye!

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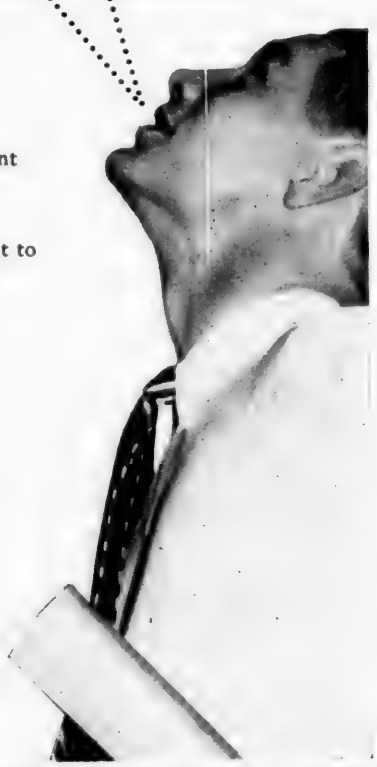
Complete concealment of the air diffuser within the handsome light fixture means freedom for the architect to design clean, uncluttered ceilings, greatly simplified mechanical planning for the engineer and . . . for the contractor . . . faster, easier field installation.

Write for detailed literature and the name of the representative in your area.



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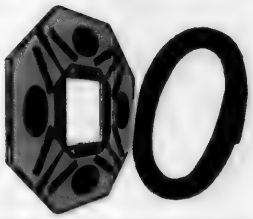

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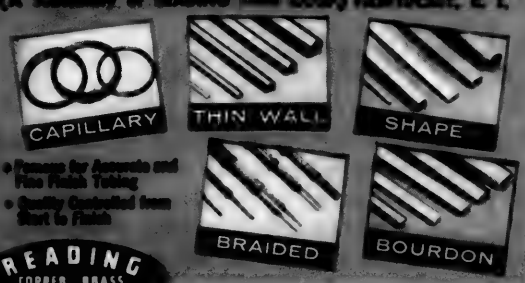

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A line of heat transfer tubing made by Readi-Fin Mfg. Co., Inc. (a subsidiary of Reading Tube Corp., at Reading, Pa.). The extended surface is extruded from the tube wall, thus eliminating the possibility of fin failures resulting from thermal shock, corrosion and erosion. This "one-piece" (integral) construction provides maximum heat transfer efficiency, ruggedness, easy fabrication and freedom from fouling. It's available in Water Tube types with finned or plain ends and in Condenser Tube types with finned, plain or stripped ends.

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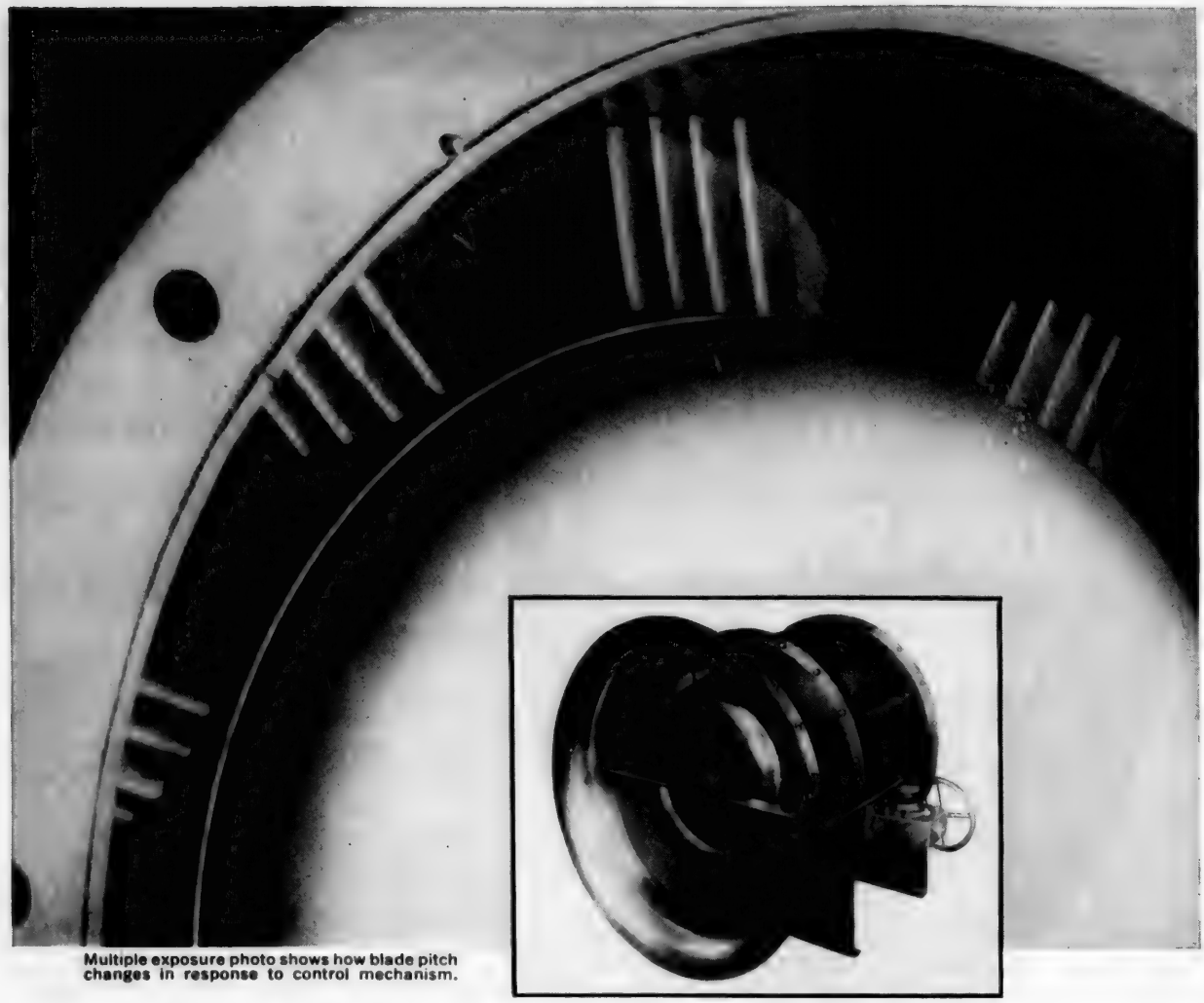


Multiple exposure photo shows how blade pitch changes in response to control mechanism.

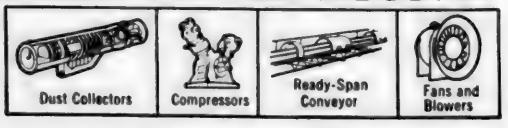
Automatic Adjustment of Air Supply to CO_2 Concentration, Temperature or Humidity with Joy Controllable Pitch Axivane® Fans

The blade pitch on Joy Axivane Fans can be changed automatically while the fan is running, varying the air volume as much as ±20%. The controlling mechanism can be linked to a sensing device to make air volume respond to a change in ambient temperature, humidity, concentration of a gas, or any of a number of conditions.

Controllable Pitch Joy Axivane Fans are ideal for ventilation of vehicular tunnels and work areas in which noxious gases tend to collect, maintaining air cooled equipment at an even temperature, stabilizing moisture content in an area, or any application requiring a variable supply of ventilation air.

Write for complete details on how Joy Controllable Pitch Axivane Fans can be made to suit your particular situation. Ask for bulletin 289-40.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

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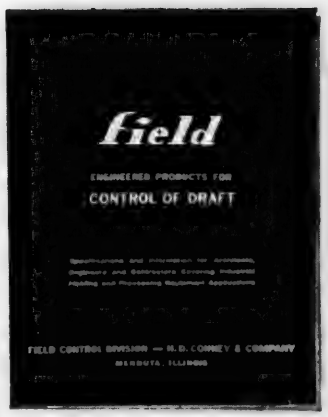
If you design, specify, install or service heating equipment you will find these technical brochures on the control of draft an important aid.

May we send you copies?



Handbook and Installation Guide

FIELD CONTROL DIVISION

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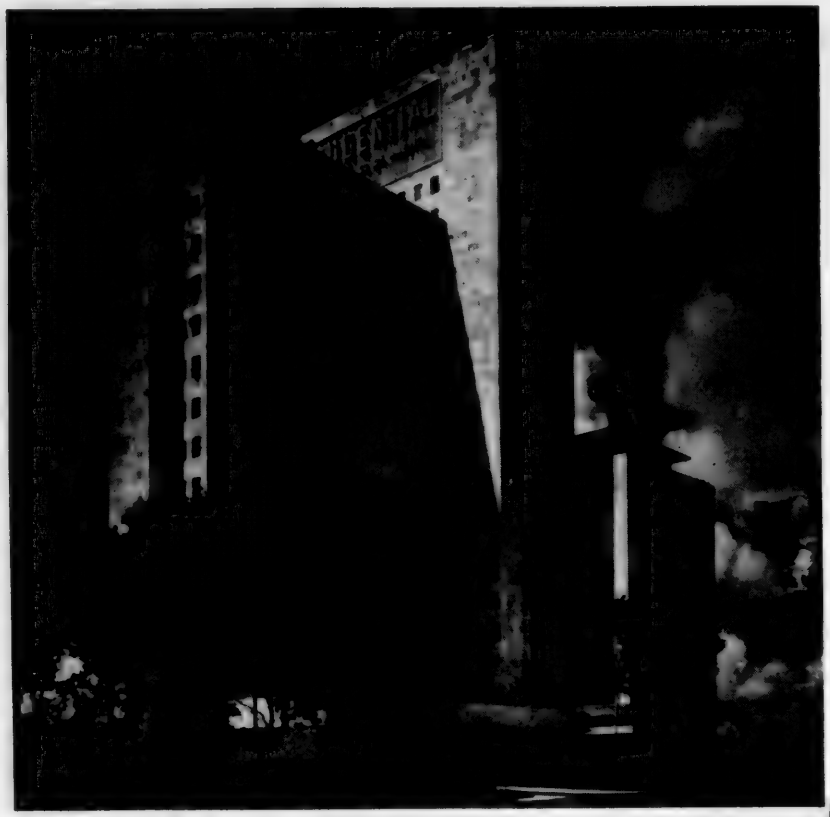
Specification Guide



Architect: Kenneth Franzheim and Associates, Houston

General Contractor: W. S. Bellows Construction Corporation, Houston

Engineer: Dale S. Cooper and Associates, Houston

Heating and Air Conditioning: Barber, Inc., Houston

Heating and Air Conditioning with

USS National Pipe—

Houston Office
The Prudential Insurance Company of America

A prominent fixture on the Houston sky line is the massive 21-story Houston Office of The Prudential Insurance Company of America. Within this modern structure, Prudential employees enjoy the year-round comfort of a heating and air-conditioning system served by 120 tons of USS National Seamless Pipe in sizes 4" O.D. through 16" O.D.

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Do you need quality pipe for air-conditioning, heating and power installations? Seamless or butt-welded pipe that will pay you back in outstanding service a hundred times over for every dollar you spend for it? Then be sure to say "NATIONAL PIPE." If you'd like further information or immediate assistance with your pipe problems, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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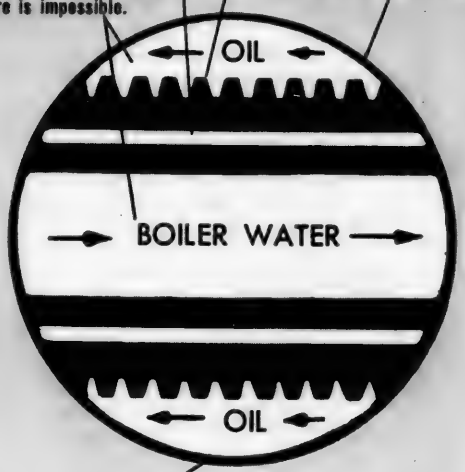
HOW TO USE BOILER WATER DIRECTLY IN A NO. 6 FUEL OIL HEATER WITHOUT DANGER OF SYSTEM CONTAMINATION

THERMO-FILM* —the safety barrier heat transfer liquid—is extremely thin to maintain maximum heat transfer.

EXTENDED SURFACE of outer tubes substantially reduces size and weight of heater.

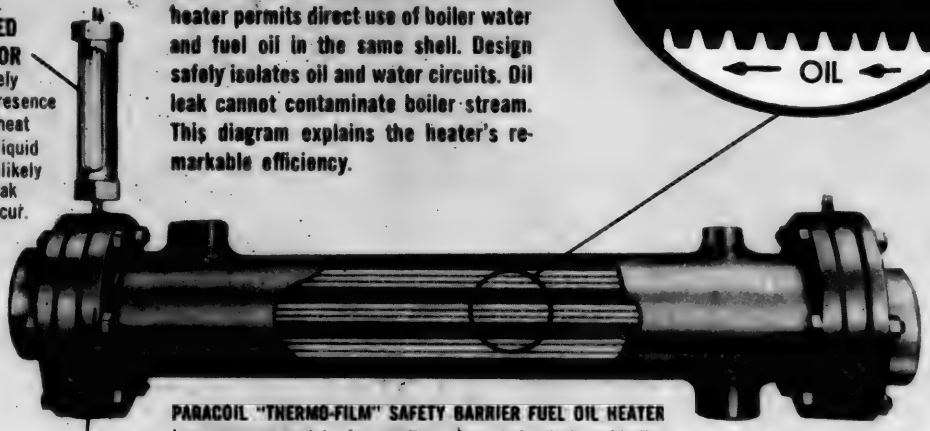
COMPLETE ISOLATION of boiler water and fuel oil is accomplished by a coaxial tube assembly, with heat-transfer liquid between inner and outer tubes. **Boiler contamination in event of oil tube failure is impossible.**

100% COUNTER FLOW results from straight tube construction. Heated oil exits at end where boiler water enters at its highest thermal head—another design feature assuring maximum overall heat transfer.

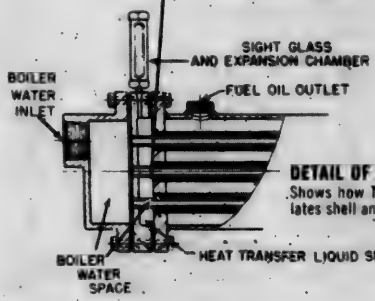


This Paracoil Thermo-Film* fuel oil heater permits direct use of boiler water and fuel oil in the same shell. Design safely isolates oil and water circuits. Oil leak cannot contaminate boiler stream. This diagram explains the heater's remarkable efficiency.

IMPROVED INDICATOR immediately reveals presence of oil in heat transfer liquid in the unlikely event a leak should occur.

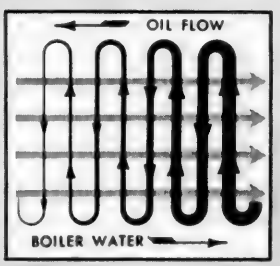


PARACOIL "THERMO-FILM" SAFETY BARRIER FUEL OIL HEATER
Low pressure model—for gravity or forced circulation of boiler water. Provides maximum capacity with minimum size. Also available but not shown: high pressure models, for use with high temperature hot water or steam as the heating medium.



DETAIL OF END CHAMBER
Shows how Thermo-Film* isolates shell and tube side fluids.

INTERNAL TURBULENCE
Oil, with low pressure loss, passes in baffled flow across heating tubes—further increasing heat transfer rates and reducing bulk of the heater. (Thickness of oil flow line represents viscosity).



*Trade Mark Reg., U.S. Patent Office

Paracoil HEAT TRANSFER EQUIPMENT

For details, write for Bulletin 60-N

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(A Division of American Metal Products Company)
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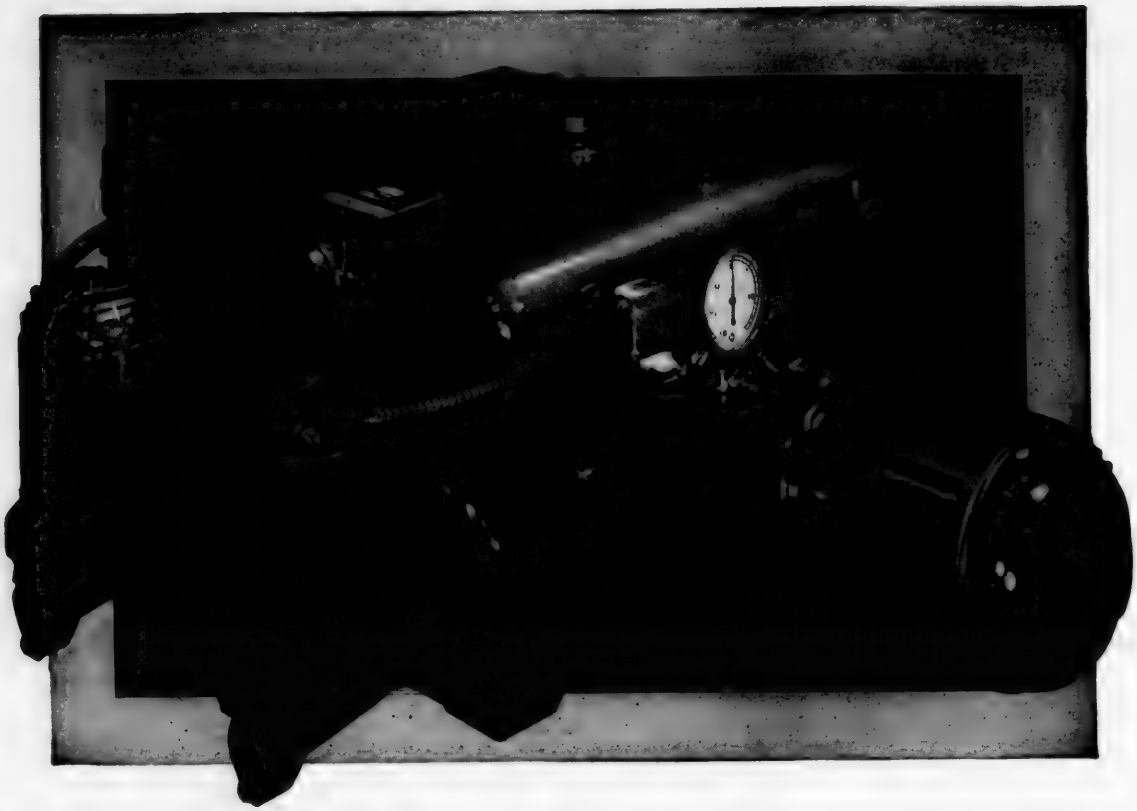
THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

Twenty-one high speed press units are located in this air conditioned press room of the Miami Daily News. Five large air filter units above presses help remove ink mist and paper fly.

Air Conditioning Printing Plants

RICHARD S. ARNOLD

Manager, Application Engineering Department, Machinery and Systems Division, Carrier Corp., Syracuse, N. Y.

There is no one method for solving air problems peculiar to the printing industry. There are, however, recommended procedures and equipment types, and these are described. The information presented provides a basis for handling virtually every problem, whether it is air conditioning for processing or for comfort.

SINCE Johann Gutenberg first pressed movable type against paper 503 years ago, thereby putting a host of quill-wielding monks out of business, the art of printing has become one of the world's ranking industries, grossing $3 billion annually in the United States alone.

Although the printer no longer carves his own type or splashes ink on his press with a mop, he is still a craftsman, proud of his skill and slow to change some of his old techniques. Even today he may be reluctant to accept the economic advantages of air conditioning, although the industry for controlling surrounding environment was actually born in a Brooklyn lithography plant in 1902.

Printers who have accepted air conditioning as part of the machinery of a printing plant, have found that air conditioning has increased economies and improved quality

To make a profit in the printing business, work must be scheduled accurately, production time kept as low as possible, and the last ounce of productivity squeezed from press and printer. It is this last ounce which produces profit. Increased economies do not spring from one source, but rather from the elimination of a host of small delays. When an owner says that problems in his plant do not justify air conditioning, chances are that he is unfamiliar with many of his real troubles.

Weather problems in an unconditioned plant may require pressmen to hang wet towels on the radiators to kill static electricity, or to sponge down rollers in the hope of getting acceptable ink distribution.

Owners of air conditioned shops have found that where an air conditioning system has been designed to fit a printing plant's needs, handsome dividends will result. These requirements vary according to production volume, physical structure, and type of printing.

There are three basic printing processes.

1. Letterpress is the oldest and most common technique, wherein ink is deposited on raised surfaces.
2. Offset is the process of printing from a flat plane.
3. Gravure, or rotogravure, involves printing from a depressed surface.

When designing a system, the air conditioning engineer should familiarize himself with these aspects, the plant's geographic location, and heat and moisture loads to be handled through the year. There is no one exact combination of temperature and humidity that can be specified for all printing operations. Each is an individual problem. Therefore, close cooperation with the plant owner or manager is valuable and necessary in obtaining the best system at reasonable owning and operating costs. Table 1 lists the air conditioning needs for the various departments of a large printing plant.

Problems peculiar to this application and recommendations for solving them will now be described. For simplification, methods for solving climatic hindrances are dis-

TABLE I—AIR CONDITIONING NEEDS OF A PRINTING PLANT

Plant Area	Air Conditioning Needs
Office	Comfort air conditioning
Offset plate department	Humidification, dehumidification, air cleaning and cooling
Foundry	Ventilation, air cleaning and spot cooling
Composing room	Comfort air conditioning and ventilation
Proof room	Comfort air conditioning
Job press room	Comfort air conditioning and humidification
Offset press room	Humidification, dehumidification, heating, cooling and air cleaning
Web press room	Heating, humidification, and air cleaning
Bindery	Winter humidification
Stock conditioning	Adjustable humidity
Stock room	Same humidity as press room
Shipping room	Heating

cussed under product classifications, starting with the smallest unit.

Room Unit

Window air conditioners can satisfy a wide variety of applications, ranging from the one-man shop to the business office of the largest plant. Their greatest effect is on employee comfort, morale and health. For example, production losses sometimes can be attributed to the common cold and to other ailments due in part from uncontrolled atmospheric conditions.

The room unit is also used as a stabilizer in production. Crescent Card Company of Dallas, Tex., solved the problem of crippling heat and humidity by locating a unit on a platform at the end of a press conveyor belt. Air is ducted from the front grill of the unit and diffused over a 4 ft section of the belt. The 55 deg F air helps dry the ink and "set" resin dust, which is blown over the cards when they are still wet. This dust prevents ink from smudging, and insures high quality embossed printing. For the owner, a small investment eliminated hand drying of cards and speeded up output.

Under varying atmospheric conditions, ink cannot be uniformly dried so that delivery dates are missed and plant schedules are disturbed. Humidity and temperature variations also bring about a process that pressmen call "doctoring," wherein ink is thinned with a solvent to obtain the desired consistency. If printing were done at constant temperature, there would be no need for this.

Packaged Units

One of the biggest headaches in any printing plant, regardless of size, is the effect of weather variations on paper. Too much humidity makes paper stock bloat; too little makes it shrink. And when paper is piled in stacks, such as for sheet-fed presses, expansion or contraction can produce wavy edges and make proper feeding difficult, if not impossible.

Moisture content is not the same for all types of paper. Coated stock will absorb less moisture than newsprint, for example. With a variation of 10% relative humidity above or below 50%, paper will absorb or release 1% of its substance weight. But in an air conditioned plant, paper can be left in uncovered piles for weeks without becoming wavy-edged.

Grove Printing Company of Waco, Tex., solved its paper problems with a self-contained unit of 10-ton cooling capacity.

Packaged units, workhorse in the line of air conditioning equipment available for controlling interior environments, particularly in small job shops and newspaper business offices, are factory-fabricated and ready to work when connected to an electrical supply and either air or water condensing service.

These units can provide both heating and cooling either with conventional heat pump operation, or cooling alone. Packages range from two to 35 tons cooling capacity, and their single or multiple installation permits application in virtually any type office or shop at what is generally the lowest cost.

In the conditioner at Grove Printing, two compressors of five hp each can be operated independently of each other, thereby providing flexible operation. A packaged cooling tower is located outside on a loading dock, just the other side of the wall from the conditioner. A duct from the unit serves a paper storage and supply room to keep paper stock at the same conditions as those in the printing area. Maximum utilization of space, so important in a small shop, is possible because the paper can be used as it comes from the storage area, without a conditioning period in the press room.

This plant owner states that a year-round temperature of 80 deg. and 60% relative humidity maintains optimum conditions. Paper curling is eliminated and stock holds its size, texture and weight.

He also found that air conditioning helps him save 50% on roller cost. These rollers for the printing presses are made of glue and glycerin; rollers (which pick up and deposit ink) are susceptible to high humidity. It is not uncommon for a seasoned roller to swell ¼ inch in circumference in a relative humidity of 70%, making good press work hopeless.

Humidity Controlled

The Allied Printing Company, of Indianapolis, Ind., solved its humidity problems with a self-contained unit adapted for the job. A manually-operated bypass was installed in the back of the unit. The design also included a plenum, electric strip heaters for reheat control, and a room thermostat which automatically starts the refrigeration compressor whenever temperature goes above 80 deg. F. This system gives process control plus employee comfort. Humidity for process control is held between 47 and 53%. A hygrostat set at 50% relative humidity operates the refrigeration cycle and also the electric strip heaters.

According to Allied, this single unit paid for itself within a year, permitting the presses to roll despite the weather.

This equipment can be a boon to the printer who has all the problems of a large plant, but whose budget cannot stand investment in a central system, or where future plans may call for add-on equipment. Such was the case of *Newsday*, fast-growing Long Island Daily newspaper.

Most newspaper press rooms are located in deep basements, insulated from summer heat that beats on the pavements above. But Newsday's press room is at ground level, surrounded on all four sides by big windows and exterior doors. Adding to the heat load are electric motors, totaling 800 hp, for driving *Newsday's* high-speed

presses. When this paper's circulation jumped from 15,000 to 256,000 in 15 years, management began looking for some way to air condition the plant without making a major investment. The answer was self-contained equipment totaling 55 tons for area cooling.

In the *Newsday* pressroom are nine water-cooled self-contained units, strategically placed. This room is 209 ft long. Air discharge plenum louvers direct conditioned air to working areas. The composing room is handled by a separate applied system with well water used for condensing to further reduce operating costs. Editorial and other office spaces are equipped with 18 self-contained units, delivering conditioned air through short duct runs.

Accurate Registration

Offset lithography is a printing process using photography as a means of transferring an image to a thin, photo-sensitive metal plate. This plate is then used to print the image. Offset is a rapidly expanding process because of its excellence in color printing.

In color work, from one to four plates may be used. The negatives from which these plates are made are subject to expansion and contraction, and when plates vary in size, colors will overlap and be out of register. Coated plates, used for long press runs, will alter their photographic sensitivity and cause variations in exposure time when atmospheric conditions fluctuate.

The National Bureau of Standards and the Lithographic Technical Foundation prescribe that humidity should be held between 45 and 55%, within plus or minus 2%. Temperature, determined by the printer, must also be held constant, within plus or minus two degrees.

The Foundation has also labeled static electricity as a frequent, and unsuspected, cause of mis-register. The best answer to this problem, it states, is pre-conditioned paper and air conditioning with a minimum of 50% relative humidity.

In multi-color printing there may be some time between impressions or runs for respective colors, and unless the paper is kept under controlled conditions during that period, moisture will change the size of the paper so that exact register is impossible. Humidity changes have been known to stretch or shrink large sheets a half inch or more, whereas perfect register requires accuracy within 1/200th of an inch.

Applied Systems

Eureka Specialty Printing Company, Scranton, Pa., which does the fine registration printing required to produce tax stamps, tuberculosis seals and trading stamps, had problems of mis-register and uncomfortable working conditions before installation of an air conditioning system with 50 tons cooling capacity.

Components were applied to fit the requirements. For example, a reciprocating refrigeration compressor is located on the ground floor. An air handling unit is directly above in the center of the second-floor offset shop, and the evaporative condenser and receiver are located on the roof. The unusual configuration of the building made this arrangement most satisfactory. Equipment took no manufacturing space and required the least amount of piping.

Richard S. Arnold joined Carrier Corp. as a field engineer upon his graduation from Stevens Institute of Technology. Two years later he became an engineering draftsman, responsible for field layouts of complete air conditioning systems. In 1939 he was assigned to the Atlanta office, and became chief engineer of the Southeast district in 1945, specializing in system design. He was transferred to the home office in Syracuse in 1952 as manager of the Application Engineering Department of the Machinery and Systems Division.

For buildings of moderate size, where load can generally be satisfied by a system having a cooling capacity from 40 to 150 tons, and where space, centralized maintenance, unobtrusiveness and greater durability are required, packaged refrigeration and air handling components are used in what is called an applied or built-up system.

At Eureka, two ducts from the air treating unit serve two large offset rooms. Room air returns directly to the unit without the use of ducts. Outside air is admitted to the air mixing chamber through minimum and maximum dampers. The minimum outside air damper is opened when the supply fan is started. The maximum damper is closed during summer and is modulated during marginal weather.

A manual summer-winter switch produces this action on the damper, as well as energizing the refrigeration cycle for summer and de-energizing it for winter. A compensated dewpoint controller allows dehumidified air temperature to rise or fall, depending on the room humidity as determined by a humidistat in the master zone.

Zone temperature control is obtained by operation of zone thermostats on their respective reheat coils. This has proven very economical. The compensated feature of the dewpoint control contributes to saving refrigeration in summer and heating in winter.

A temperature of 78 deg. and a relative humidity of 48%, plus or minus 2% is maintained. Close control is secured by a pneumatic system which used the unloading feature of a compressor for its success.

An example of another use of offset lithography is under study at the Rochester Institute of Technology in Rochester, N. Y. The school's Graphic Arts Research Center is experimenting with a rapid, low-cost method for quality reproduction in newspapers. When this technique is perfected, newspaper press rooms will more than ever require air conditioning to effect further economies.

The RIT color press laboratory is equipped with a 40-ton reciprocating refrigeration liquid chilling package which supplies chilled water to two fan-coil type conditioning units. Air is distributed through overhead ductwork to ceiling diffusers in each of the laboratory's five departments: photo composing, plate-making, stripping, film processing and press room. A thermostat in each department signals for heating and cooling to maintain the desired 76 deg. and 45% relative humidity.

Plate-making rooms present serious problems for the lithographer, problems which RIT has escaped because of air conditioning. The high concentration of fumes from etching acid, which could affect the health and comfort of workers, are dissipated and removed. Cooling and/or heating coils in the vicinity of this room

Low pressure overhead ducts serve the press room of I. S. Berlin Company, Chicago. Air handling units on the roof are provided with chilled water from a 340-ton centrifugal machine.

should have copper tubes and fins to resist acid corrosion. Sprays with proper bleed-off are an additional precaution in preserving coil life.

RIT has had great success testing new inks, papers and printing techniques because of its stable atmospheric conditions. New "heat-set" color inks, which require a special oven installed on the press to facilitate rapid drying, plus color printing on aluminum foil, have been pioneered there.

Central Station Systems

One of the most difficult projects to air condition in the printing field is a newspaper building, a conglomeration of areas with different heat loads and problems.

A case in point is the Atlanta (Ga.) *Journal-Constitution*, one of the nation's outstanding newspapers. Its eight-story office building was erected in 1897 and purchased by the publisher in 1942. Six years later a four-story mechanical building was erected next door with 11,000 sq ft per floor.

The new building was ventilated, but when outside temperatures reached 100 deg. the system could do very little for the comfort of sweltering pressmen and composing room employees. And management expressed concern over ink mist, paper dust, and low humidity that caused troublesome static electricity.

A newspaper press room not only must be heated and ventilated, but it must also be humidified. Humidification results in better press work, better looking paper and snappier photo reproductions. One surprising result of humidification is that it may reduce ink consumption, because when paper and rollers are in optimum condition, less ink needs to be run to secure proper color.

When humidity is too low, paper becomes dry and the resultant static electricity makes paper cling to itself and to press rollers. In high-speed presses, static is a major cause of breaks in the "web," the continuous roll of paper that is fed through the press. When the web breaks, the press must be stopped and re-threaded.

In a high speed web press, centrifugal force causes particles of ink (mist) and paper (fly) to leave the press and float about the room, coming to rest and accumulating on walls and equipment. The amount of mist and fly increases with press speed. This is both a nuisance and a fire hazard, since printing ink is composed of kerosene, carbon, linseed oil and other inflammables.

There is an even greater fire hazard with the use of rotogravure (brown) ink. Static sparks have been known to ignite the mixture of mist and fly thrown off by fast gravure presses.

The *Journal-Constitution* uses high-speed presses which revolve at 400 rpm. To combat mist, and to solve many other problems caused by weather variations, Journal management had an air conditioning system installed, complete with filtration apparatus for the press room. Chilled water was provided by a single, large-capacity centrifugal refrigerating machine.

In the huge press room, which is 150 ft long, 50 ft wide and 30 ft high, four air cleaning units are spaced along and over both rows of presses. Each unit is equipped with two automatic, dry-type filters with a capacity of 5,000 cfm. A continuous sheet of two-ply filtering paper unrolls from the top and moves down over the face of the filter. A roll will last four to five weeks.

Three exhaust fans draw room air through the filter media, a common exhaust duct and a central air shaft. Since only filtered air passes through the duct, fire hazard and maintenance in the duct are reduced.

Ink mist can be handled in two basic ways. One is to use all outside air, with an exhaust system located so that the major portion of the mist is removed and not permitted to diffuse into the room. The second is to use part return air, depending on filters to remove the mist, thus maintaining a low concentration in the space and keeping the cooling coils from being clogged.

Steel wool, glass wool, or other types of non-automatic filters may be used, but they are not recommended for ink mist removal. Steel and glass wool filters clog easily, and the inflammable nature of printing ink adds to the fire hazard.

To benefit press operators, control humidity, and remove ink mist and paper fly, a distribution system was designed introducing air at three different levels. By supplying conditioned air at the lowest level and exhausting it at the highest point immediately above the presses, ink and mist are directed, with the aid of thermal currents of rising heat, from the presses to the point where it is trapped.

Air is supplied to the press room at 98,000 cfm, and is exhausted at 102,000 cfm. The negative air pressure which results is desired to avoid ink leakage through doors and openings into other portions of the building. There are approximately 320,000 cu ft of space within the press room, and an air change is accomplished every 3.25 minutes.

Figuring The Cooling Load

Determining the load factors in a web press room is a highly specialized problem. With intermittent operation, such as a newspaper, load factors of fairly large proportion can be applied. But where press operation is almost continuous, such as for magazine or telephone directory printing, the load factor approaches 100% of

the operating load. The latter, however, may be considerably lower than the starting load.

To calculate the load factor and room load, it is necessary to carefully analyze (1) ratio of press production to full capacity, (2) starting input to running power requirement, (3) operating time to continuous operation, and (4) frequency of operation.

For example, 31 motors of 40 hp each, plus an additional 142 hp load from small motors, contribute to the heat load at the Journal. After studying press operation, and considering thermal storage, operating time and flywheel effect, a load factor of 0.75 was applied to the nameplate horsepower of the press, and a load factor of 0.10 to the small motors. Each installation must be evaluated individually, but elements of storage, requirements for providing satisfactory press performance at the most reasonable cost, and experience all contribute to establishing load factors.

A reduction in size and cost of air ducts may be effected by a careful scrutiny of the heat load, taking into consideration these factors. Further reduction in duct size may be realized by increasing air velocity, since noise is no problem in a noise-deafening press room.

The load factor varies considerably for each press room, and for different days of the week. This is due to the number of pages printed in each edition. Internal sources of heat will reach their maximum after sundown in a plant printing a morning paper. In an afternoon paper, the maximum will usually coincide with maximum external conditions.

Besides load factor, there is also the important item of heat lag due to the mass of machinery and building, known as "storage." When a press room is operating intermittently, this is of importance in determining the overall load factor to be applied in the air conditioning calculations for reduction of equipment size.

It is advisable to operate the air conditioning after the presses have been shut down until the heat is removed from press frames and the building so that they will be at normal temperature for the next operation. Pre-cooling at somewhat lower temperatures before operation, can be effective in reducing equipment load.

Taking all outside air increases the load on air conditioning equipment and it is, therefore, necessary to study weather bureau records to determine wet bulb temperatures that will occur during operating times, be it day or night.

Paper itself picks up large quantities of heat as it passes through the presses. If paper is removed from the press room immediately after it is printed, a sizable reduction in heat load can be effected.

Removing Press Room Heat

The air conditioned *Los Angeles Times* is an excellent example of heat load problems, and may serve as a guide to arriving at appropriate figures for similar installations. Numbers in parentheses in the following paragraph, tie in with the figures in parentheses under the equation to show the source of the figures used.

At the *Times*, power required to operate the presses is approximately 60% of the motor nameplate rating (load factor). The driving motor is located in the reel room, where rolls of paper are placed during press runs. When the driving motor is outside the press room, motor inefficiency should be deducted from the press room load, but in this case, added to the reel room load. Some motor input is likewise utilized in driving the reels. The deduction under this heading amounts to about 20% of the motor's input power. Or in other words, 80% (2) of the load is delivered to the press room.

When a newsprint roll is kept in a conditioned space equal to or at lower temperatures than the press room, some 15% (3) of the heat dissipated through the press results in from 5 to 10% rise in paper temperature. This heat is carried off as the papers are removed from the press room.

The press itself rises in temperature. Those parts having the greatest mass may increase some 5 deg. after three hours operation, while some frame parts may rise 15 deg. A good average would be slightly above 5 deg. This would amount to about 25% (4) of the total heat dissipated in the press. Allowance can be made for this, provided that the presses do not run continuously, and provided that the air conditioning plant is operated to cool the presses while they are not running.

From the above information on the *Times*, we arrive at the following load factor for the press motors:

$$100\% \underset{(1)}{\times} 0.60 \underset{(2)}{\times} 0.80 \times (1 - \underset{(3)}{0.15} - \underset{(4)}{0.25}) = 28.8$$

(or 30% of the nameplate rating).

At the Journal, the outside air load was calculated on the basis of 50% outside and 50% return air, but the operating intent is to use all outside air whenever possible. The controls, therefore, are designed so that the apparatus dewpointstat will open the chilled water valve, using available chilled water before modulating the outside and return air dampers.

A spray type washer is used to supply constant dewpoint temperature air to the space by controlling from a dewpointstat, a chilled water valve during summer operation, and a preheat and spray water heater valve during winter operation. Room temperature is maintained by a thermostat in the press room, modulating a volume damper and reheater steam valve.

The other three floors of the Journal building are handled by a central conditioning plant located on the roof. Air is distributed by conventional methods.

The most expensive "equipment" in any printing plant or newspaper building is its personnel. Pressmen, linotype operators and other printing specialists are highly skilled and well paid, and their health and morale are vital to management. The advantages of air conditioning toward decreasing absenteeism and turnover, attracting high caliber personnel and increasing productivity are well known.

Hermetic Centrifugal Machine

The Miami (Fla.) *Daily News* carefully considered its personnel when it moved into new, modern headquarters recently. The entire two-story building, with 176,000 sq ft of floor space, is supplied with year-round air conditioning by three hermetic centrifugal refrigeration machines of 430 tons capacity each.

These compact, completely integrated machines furnish chilled water to 23 air handling units hidden throughout the building. Hot condenser water is pumped 150 ft underground to an outside cooling tower.

Conditioned air combats the torrid Miami summers

Letterpress department of The Universal Printing Company, St. Louis, Mo. Four separate air conditioning systems are installed in this plant.

through supply ductwork leading to outlets in all areas. An occasional winter chill is dispersed by circulating hot water through the coils from a roof boiler.

The composing and stereotype rooms are the most vital where human comfort is concerned. Many people in these rooms, brilliant lighting, and heat-producing machinery combine to produce tremendous heat loads. At the News, there is continuous circulation of conditioned air, maintaining interior conditions of 78 deg and 50% relative humidity.

Of primary concern in the composing room is elimination of localized heat gain from linotype and monotype machines. The Mergenthaler Company, leading manufacturer of the linotype machine, states its machines give off 43,700 Btu during an 8-hour day. The pots used for melting lead operate at 550 deg. Electric pots do not require special ventilation, but gas pots should be vented to get rid of fumes and heat.

Experience has shown the load factor for linotype machines to be about 65% of the total connected horsepower load. The lead melting pots have a load factor of 30% when there is ample positive exhaust for each machine.

Monotype machines are usually rated at 25% of the connected horsepower load. Gas-heated pots radiate about 1,000 Btu per pot. It is necessary to exhaust large quantities of air directly from each machine to remove heat and fumes. Air should be supplied near the floor to permit it to flow up around the operator.

The amount of exhaust and ventilation is often fixed by codes and should be investigated. If it is not covered by codes, a good general practice is to install a ventilating system to handle about 400 cfm per pot to carry off fumes and some of the heat. This figure, however, should be checked with the manufacturer of the machine in question.

Any composing room air conditioning system should be designed so as to eliminate drafts and uneven temperatures. The operators must sit at their machines all day, and are especially sensitive to drafts. Distribution of conditioned air should be designed to blow air over the operator toward the lead pots for removal by the exhaust system for each unit. This will keep fumes and excess heat away from operators.

The stereotype room, where lead plates are cast in a foundry, is the hottest spot in a newspaper plant, but it is also lightly populated. It is not usually practical to cool the entire room to comfort conditions. Spot cooling will give tolerably cool conditions at points where workers stand. Sufficient outside air must be introduced to provide adequate ventilation.

Absorption Refrigeration Machines

Where low pressure steam, high temperature water, petroleum or other hot liquids are readily available, absorption refrigeration may be the answer to a chilled water source for year-round central system air conditioning. Newest of the refrigeration methods is the absorption machine available in cooling capacities for single units up to 705 tons.

The Gulf Printing Company of Houston, Texas, is a new user of the absorption machine, consuming cheap natural gas to produce its steam power. This company publishes three oil industry magazines; a new addition to its plant has made it the largest printing house in the Southwest.

Gulf's streamlined new plant and facilities has a 435-ton absorption machine which furnishes chilled water to seven fan-coil units from its penthouse atop the one-story building. The machine's vibrationless performance and light weight facilitates rooftop placement, and its few moving parts assure nominal maintenance.

Outside air mixed with return air is distributed through the plant by a network of ceiling ducts. Temperature is held between 75 and 78 deg. and relative humidity between 50 and 55%.

The Flint (Mich.) *Journal* has also found the absorption machine to be the answer to its problems. Its management had experimented with several ventilating systems, using well water as a coolant. However, the well water suddenly began to warm up, and with the additional problem of expansion of office and mechanical space, summer temperatures in the building seldom went below 95 deg.

The solution was installation of two 150-ton absorption machines because an existing boiler could produce 12 psi steam for energizing the machine. Generally these units do not require a licensed operator, thus saving a salary.

Elimination of Moisture

One problem that occurs, although infrequently, in newspaper and printing plants in northern climes is that of moisture condensation on windows and skylights when outside air is cold and dry. Dirty condensate dripping from the ceiling can cause spoilage and increase building maintenance costs.

Numerous successful applications have been made by vigorously blowing heated air over exposed roof and wall surfaces, thus raising the inside surface temperature and permitting a higher room dewpoint to exist without condensation.

Final Point

Air conditioning for printing plants cannot be completely covered in a single article. The subject is too vast and too complex. If the engineer, contractor or architect needs assistance in solving a design, installation or construction problem, application engineering departments of the manufacturers of air conditioning equipment may be of help. After all, air conditioning of printing plants is as old as the air conditioning industry.

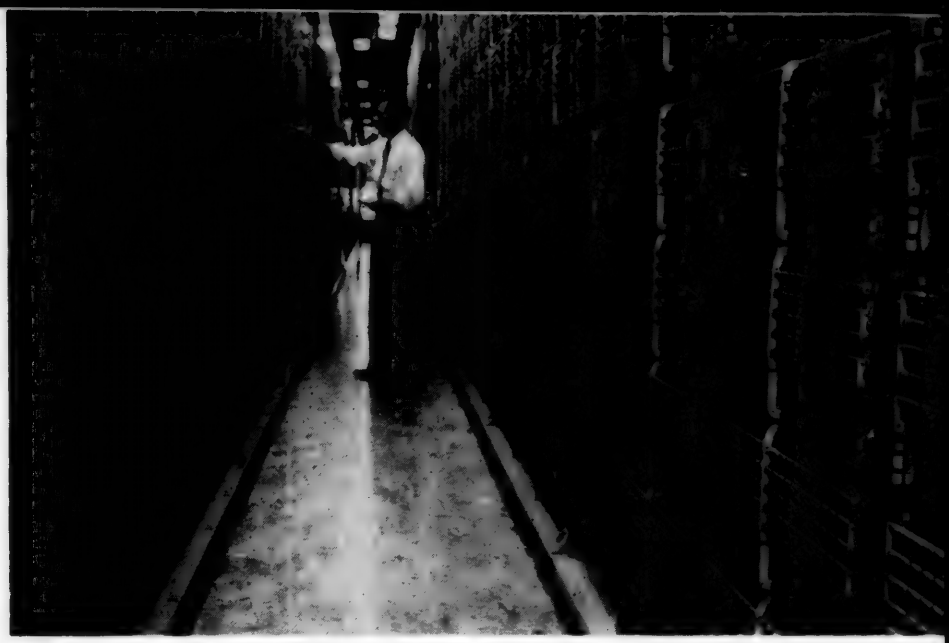


Fig. 1. Crossbar frames of a central office automatic telephone equipment installation. The many contacts and insulated wires require a special environment for best results.

Ventilation for Telephone Exchanges

HARVEY C. ROSSING
Engineer, American Telephone and Telegraph Co., New York, N. Y.

Control of humidity and dust has been studied by the Bell Telephone Laboratories for the best operating environment for automatic telephone switching equipment. Ventilation conditions are given for summer and winter operation, and a tool described for dust evaluation.

THE operating environment for telephone switching equipment—the machinery which automatically routes a call from your telephone to that of the person you are calling—is a very important element in the successful and economic operation of that equipment. Three of the factors in that environment have been topics of study and research by Bell System engineers and scientists for many years. These three factors are temperature, relative humidity and the problem of air-borne dirt.

Of the three, temperature is perhaps the least critical. The Bell Telephone Laboratories, developers and designers of telephone equipment, have so designed nearly all of it that it is able to operate satisfactorily in temperatures up to 120 deg F. This figure refers to the air temperature immediately surrounding the equipment, which is likely to be higher than average room temperature. But there are types of equipment which release large quantities of heat. In the case of this kind of installation, it is desirable, and sometimes necessary, that the temperature of the environment be controlled to assure good equipment operation.

Effect of Humidity

Humidity has its effects on equipment performance, caused mainly by changes in the percentage of relative humidity. Such changes produce dimensional variations in most insulating materials, and other non-metallic materials, except rubber, which are used in telephone apparatus. In turn, the dimensional variations affect apparatus adjustments. For example, a relay may be adjusted to 25% relative humidity, but due to dimensional change, it may be out of adjustment at 70%. Wide variations in relative humidity are important in their effect on apparatus adjustment. Automatic switching equipment is shown in Fig. 1.

The electrical constants of the textile insulation used on the wire and cable in telephone exchange buildings are affected directly by relative humidity. As the humidity increases, the mutual conductance and capacitance values increase and the insulation resistance and the voltage at which the insulation will break down decreases.

Limits of Relative Humidity

The Bell Laboratories' work on humidity problems has resulted in establishing practical limits of relative humidity to be maintained in rooms housing telephone switching equipment. They are incorporated with comments on temperature in recommendations to the operat-

Harvey C. Rossing, engineer in the Building Engineer's office of the American Telephone and Telegraph Company, was born in Illinois and received his B.S. in Civil Engineering from Illinois Institute of Technology. He worked in the Ventilation Bureau of the City of Chicago's Building Department prior to World War II. In 1946 he joined the Building Engineering group of the Illinois Bell Telephone Company, and in 1956 he moved to his present post with A.T.&T. in New York City.

ing telephone companies of the Bell System by the American Telephone and Telegraph Company, as follows:

> "*Summer—Ventilation Only*—Maintain a room condition with a maximum of 10 deg above the maximum design dry bulb temperature as listed for various localities in the *ASHRAE Guide*.
>
> "When room conditions exceed 65% relative humidity, automatically control the ventilating system to deliver a maximum of recirculated air. This will tend to reduce the relative humidity within the room thereby minimizing the detrimental effects which extreme variations in relative humidity have on switching equipment.
>
> "*Summer—Ventilation with Cooling*—Maintain a room condition having a maximum of 55% relative humidity. To maintain conditions lower than 55% relative humidity will substantially increase the cost of the refrigerating equipment and operating costs disproportionately to the benefits realized. Maintain a room temperature not lower than 13 deg below the maximum design dry bulb temperature as listed for various localities in the *Guide*. However, a reduced temperature differential is recommended for lower outside temperatures. Cool air supplied to the room should not be more than 18 to 20 deg below the room dry bulb temperature.
>
> "*Winter*—Maintain approximately 35% relative humidity in central offices and automatic message accounting center spaces. A gradual reduction in relative humidity for short periods of time may be advisable to minimize window condensation as the outside temperatures fall. Double glazing may be helpful in reducing condensation in colder areas."

Improved Equipment

Another weapon in the Bell Laboratories' attack on the harmful effects of relative humidity is the continuing effort to develop materials which are less susceptible to the environment in which they are installed. Over a period of years many improvements have been incorporated in telephone switching equipment to reduce the adverse effects of relative humidity. Reference was made to the effect of humidity on the electrical constants of textile insulation. The introduction of wiring insulated with a polyvinyl chloride (PVC) material is an illustration. The effect of relative humidity on this type of wire is negligible.

A review of the types of dial switching equipment shows further the effect of such improvements. The panel type contains more adjustable apparatus where adjustment stability and performance are adversely affected by large changes in the percentage of relative humidity. Step-by-step equipment is less affected. However, the fiber insulation originally used in some relays was subject to dimensional change with varying relative humidity and some adjustment instability was experienced. A change in this insulation developed by the Laboratories improved the adjustment stability of these relays with respect to relative humidity changes. The latest type in common use, the crossbar system, provides a type of apparatus which is less critical to humidity changes than that used in panel systems and also takes advantage of improved insulation.

In attacking the problem of air-borne dirt, the Bell Laboratories adopted the premise that exclusion of such dirt from telephone buildings was the basic remedy. Operation of the buildings with closed windows was a logical step. With closed windows, mechanical ventilation was necessary for personnel comfort and to comply with building code requirements. The problem then became one of learning what kinds and sizes of dirt particles caused equipment problems and to analyze air filters used in mechanical ventilating systems to learn which did the best filtering job at the most reasonable cost.

Special Tool

In doing this work, the Laboratories developed the contact replica tool, Fig. 2. This device was very useful in ascertaining the type and size dirt particles which actually settled on relay contacts. It was employed as follows. The clamp portion of the tool, consisting of the copper jaws, set screw and spring, was heated. With the relay contacts open, the plastic replica blank was carefully placed between them. The contacts were then closed, exerting enough pressure on the replica blank to keep it in place. Next the heated clamp was picked up with the spring tongs and its jaws were held over the contacts. The application of fingertip pressure on the spring tongs pressed the jaws against the contacts and the heat from the jaws passed through the contacts to the replica blank. The heat softened the plastic enough so any dirt on the relay contacts was transferred to the plastic. The jaws were then removed, and the replica blank allowed to cool. It was then taken from between the contacts. Laboratory examination followed to determine the characteristics of the dirt removed from the contacts.

Dust on Contacts

It was learned that quite a variety of substances found their way onto relay contacts. A list of them would include cotton, linen, wool, silk, acetate and wood fibers, pollen and spores, coke, coal, cinders, sooty aggregates, graphite, quartz particles, human hair, skin and nail particles, metallic particles and paint fragments.

Such dust causes troubles in telephone switching equipment in a number of ways. It settles on relay or switch contacts to cause open contact troubles. It may contain corrosive components which accelerate the formation of corrosion products. Such action results in development of contact resistances sufficiently high to produce contact noise and in extreme cases the development of sufficient resistance to interfere with circuit operation. Dirt accumulations may interfere with mechanical operation of moving parts and where the dirt is abrasive in nature mechanical wear will be accelerated in bearings and on contact sur-

faces. The problem of equipment cleaning is aggravated by dirt accumulations and the cleaning process itself may cause trouble with wiring and apparatus adjustments.

Examination of many dirt samples collected under actual service conditions in telephone equipment rooms showed that 90% of open contact troubles in switching apparatus were caused by dirt particles 25 microns and larger in size (1 micron = .00004 inch).

Types of Filters

The Bell system has proceeded with the work of collecting data on many filters for efficiency in various particle size ranges and for dirt holding capacity in terms of relating resistance to air flow to the weight of dirt retained on a filter. This work is a continuing project and is still being carried on. The test work covers three basic types of filters:

The impingement-type filters generally employ an adhesive coated medium, arranged so that the air passing through it is subjected to numerous changes in direction of flow. The dust particles, due to their inertia, are impinged on the surfaces of the filter, where they are held by the adhesive. The types of filter medium used include glass, wool, metal, synthetic fibers, metal wool, animal hair, plant fibers and expanded paper. Some are disposable and are discarded when dirty, others are cleaned and reused.

The screen-type filters are essentially screens, or strainers, through which dust particles larger than the screen openings do not pass. The types of filter medium used are paper, glass cloth and wool felt.

Electrostatic filters, or electronic as they are sometimes called, have an ionizing zone in which a positive electrostatic charge of several thousand volts is imparted to the dust particles in the air. The air then passes through a collector plate assembly. The plates are closely spaced and alternately have several thousand volts and ground.

Filter Recommendations

The present recommendation of the American Telephone and Telegraph Company to the operating telephone companies is as follows:

> "Research conducted by the Bell Telephone Laboratories indicates that four inches of KS-7406 glass wool filter media are adequate to minimize open contact equipment troubles due to dust. The four inches of media are obtained by placing two KS-7406 glass wool filters, each two inches thick, in tandem in the filter frame. The second filter will remove approximately 25% of the dust by weight which passes the first filter. . . . More efficient filters may be desirable in areas where the air is contaminated with large quantities of fine dust particles. Generally, electric-type filters are not required except for a few locations having extremely large dust concentrations in the air."

The KS-7406 filter referred to in this recommendation is manufactured commercially to meet Bell System specifications.

As far as electrostatic filters are concerned, it is recommended that when the necessity for this degree of filtration is established, the installation consist of an impingement-type prefilter (two inches of glass wool), the electrostatic filter, and a screen-type after-filter.

Use of Prefilter and After-filter

While the prefilter does not increase the overall filtering efficiency of the system, it will reduce the amount of dirt entering the electrostatic unit and thus lengthen the interval between periodic maintenance work on the plates.

The after-filter serves three purposes:

1. It collects dust which is not caught by the prefilter and the electrostatic filter.
2. It collects "blow-offs" from the electrostatic unit. All electrostatic units flash over occasionally, and as they flash over, they tend to release rather large pieces of dust that can be caught by the after-filter.
3. To provide a filter, if the source of power to the electrostatic filter should fail or if a failure should occur in the ionizing section of the filter.

What is the plan for future work on air filtration? It has two aims:

1. A continuing program of collecting data on available filters to maintain satisfactory sources of supply.
2. The development of a means to permit the telephone companies to sample dust themselves and to evaluate the results in terms of the type of air filter which should be used. At the present time, this contemplates the use of a spot dust sampler. The sampler would take 120 spots, a spot move every six hours, which will give a 30-day sample. It is hoped that ultimately, from an examination of the spots, it will be possible to advise a telephone company that, for a specific location, glass wool, glass wool plus a screen-type filter, or an electrostatic filter with prefilters and after-filters would be required.

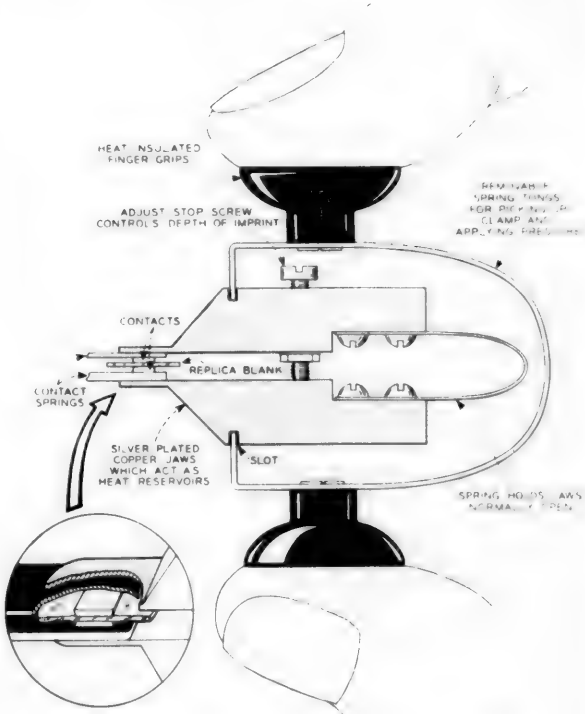


Fig. 2. Schematic of a contact replica tool.

Air Filter Selection Data

Filter Type	Average Operating Arrestance	Installation Cost	Maintenance	Annual Electric Current Cost	Total Annual Cost: 20-Year Amortization Plus Operating and Maintenance
Electrostatic Precipitator	90% with atmospheric dust; 98% with Cottrell precipitate, based on NBS Test Method.	$3,300	Needs highly skilled maintenance personnel. Safety precautions must be rigidly followed and equipment accessible for repair and replacement.	$13	$368
Automatic Self-Cleaning Oiled Metal Curtain	10% with atmospheric air; 74% with Cottrell precipitate, based on NBS Test Method.	1,900	Very little required, except to replace adhesive periodically, clean out sump, and annual overhaul. Work is unpleasant, however.	6	228
Automatic Self-Renewing Fiber Curtain	19% with atmospheric air; 83% with Cottrell precipitate, based on NBS Test Method.	1,400	Requires little care, except for periodic replacement of used filter media. Rolls of media relatively costly.	6	253
Replaceable Dry Media 10% Efficiency	Depending on the media used, almost any arrestance can be attained with this type of filter. For the units tested by the NBS Test Method, average operating arrestances range from 11-95% with atmospheric dust; 83-99% with Cottrell precipitate. Note: No efficiency tests were conducted on the latter three filters in this category. Efficiencies listed supplied by filter manufacturers.	950	Periodic replacement of the media is required. Arrestance, after replacement of the media, is dependent on the care with which media are installed and the edges sealed. As the arrestance of the media is increased, maintenance costs become extremely high. When estimating maintenance costs, great care must be used to base costs on the filters suitable for the arrestance demands.	0	162
Replaceable Dry Media 40% Efficiency		1,200		0	372
Replaceable Dry Media 90% Efficiency		1,340		0	958
Replaceable Dry Media 90% Efficiency with pre-filter		1,440		0	627
Cleanable Metal Viscid-Impingement	60% with Cottrell precipitate, NBS Test Method, with 600 fpm face velocity, 0.5-inch pressure drop.	300	Performance dependent on complete coating with proper adhesive. Facilities must be available for collecting, draining water used in washing. On big jobs, central cleaning is the most economical procedure.	0	122
Throwaway Viscid Fibrous Media	Average of 17% with atmospheric air; 78% with Cottrell precipitate based on NBS Test Method.	180	Must replace entire unit, hence high cost. Unskilled personnel is sufficient, as long as servicing schedule or pressure drop gage is available. Not economical to clean filters.	0	178

Cost data based on 20,000 cfm filtering capacity, extracted from Report 34 for Federal Construction Council prepared by Task Group T-28, Francis A. Govan, staff engineer, Building Research Advisory Board, Div. of Engineering and Industrial Research, National Academy of Sciences-National Research Council.

Resistance to Air Flow	Advantages	Disadvantages
Little resistance to air flow, but if pre-filters or after-filters are used, their resistance and maintenance must be considered in system design.	A 90 per cent arrestance for the fine particulate matter which causes discoloration. Requires little cleaning maintenance if the units are self-washing.	Highest initial cost. Skilled maintenance personnel required. Sensitivity to changes in air velocities which affects arrestance. Low arrestance against lint. When out of operation arrestance is very low. Susceptibility to power failures. Can generate considerable amounts of ozone under certain conditions. Possible source of ignition of explosive gases or vapors.
Operates at constant resistance. Curtain movement controlled by automatic timer. Small dust-holding capacity unimportant, since dirt is removed in adhesive bath.	Frequent maintenance not required. Since it is self-cleaning, replacement of dirty adhesives and cleaning of the curtain are only required occasionally. Self-cleaning characteristics permit the handling of large amounts of dust before attention is required. Has relatively constant resistance if properly operated. Automatic in operation.	Not feasible for small quantities of air. Reluctance of maintenance personnel to service sludgy adhesives. Possibility of oil carry-over into air distribution system. High initial investment.
Resistance will remain fairly constant if roll movement is controlled by pressure drop switch. Movement may be controlled with timer, thus allowing the resistance to fluctuate.	Requires little maintenance. Roll replacement is easy and does not entail removing dirty adhesives. Has relatively constant resistance when properly operated. Automatic in operation.	Not feasible for small quantities of air. High initial investment.
Low velocity types (300 fpm) have resistance of about 0.2 inches w.g. As media becomes dust laden, resistance increases until they must be replaced. Allowable resistance increase must be used for system fan design. Dust holding capacity dependent on arrestance and design of filter. Usually, the higher the arrestance, the lower the dust holding capacity.	Wide range of application. Flexibility of unit arrangement.	Dependent on thoroughness of maintenance personnel. High maintenance costs. Regular maintenance required.
Relatively low resistance, high dust-holding capacity. Allowable increase in original resistance, due to dirt-loading, must be included in calculation when making fan selection.	Low operating resistance. High dust-holding capacity. Flexibility of application.	Pressure drop and arrestance after cleaning are dependent on the care of maintenance personnel in cleaning and recoating the unit. Reluctance of maintenance personnel to properly clean this filter manually due to the difficult and unpleasant job involved. Possible damage to metal filter media. Adhesive carry-over. Need for facility at or near installation for cleaning, washing and draining.
Relatively low resistance when clean; about 0.15 inches w.g. Resistance increases rapidly with dust-loading and velocity of air.	Requires no special skills for maintenance. Low first cost.	High replacement costs. Limited dust-holding capacity.

Solar Radiation on Walls Facing North and South

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The receipt of solar radiation on vertical surfaces facing East and West was investigated in an article by the author in the October, 1958, issue of this publication. The following article completes the study of solar radiation as received on vertical surfaces of the four cardinal points at the U.S. Weather Bureau's Solar Radiation Observing Station at Blue Hill Observatory, Milton, Massachusetts.

A PRELIMINARY investigation of the measurements of solar radiation on vertical surfaces was made by Hand (1). In a previous article by the author, the receipt of solar radiation on vertical surfaces facing East and West was investigated (2). This paper completes the study of solar radiation as received on the vertical surfaces of the four cardinal points.

At the Blue Hill Observatory solar radiation received directly from the sun was measured by Eppley pyrheliometers suspended on the North and South sides of the tower some 26 feet above the ground surface and 670 feet above sea level. North vertical measurements were recorded for 7 years and South vertical measurements for 10 years. Measurements were recorded on Brown Electronik potentiometers.

Radiation received on the North vertical surface can be separated into two classes depending upon the season of the year. Between the vernal and autumnal equinoxes (March 21-September 23), the radiation consists of direct and of diffuse sky and ground reflected components. During this warm half of the year, the direct radiation impinges on the North wall for as much as three and one half hours immediately after sunrise and for a like period of time prior to sunset. Throughout the middle of the day, diffuse sky radiation and that reflected from the ground constitute all the radiation received on the North wall. Between the autumnal and vernal equinoxes (September 23-March 21) or the colder half of the year,

Fig. 1. The author is shown with a Smithsonian silver disc pyrheliometer, used as a standard in calibrating the Eppley units which furnished measurements for this article.

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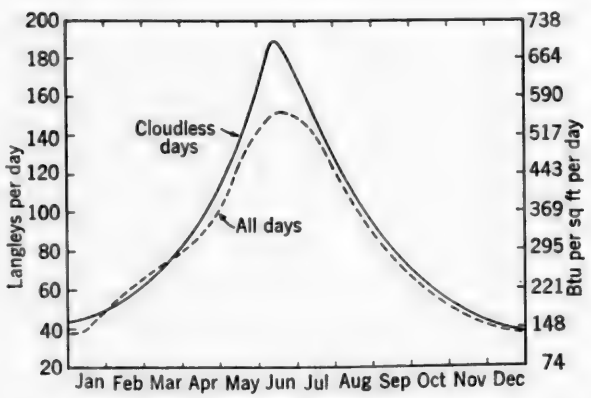


Fig. 2. Average monthly values of radiation received on the North vertical surface for cloudless skies and for all days of record.

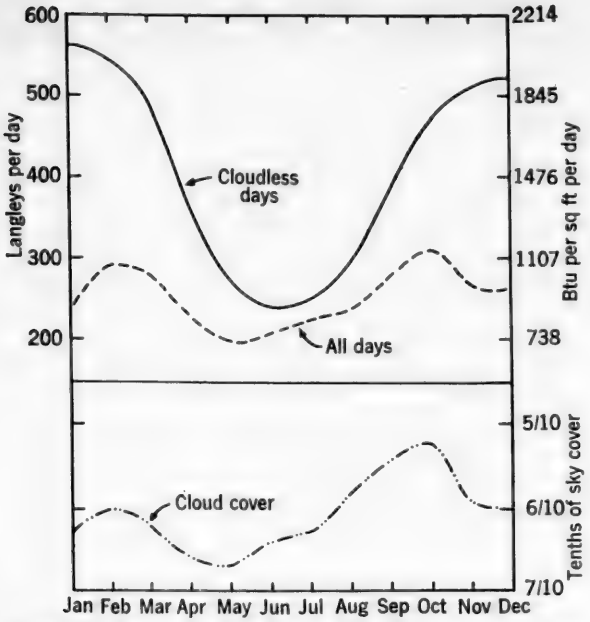


Fig. 3. Average monthly values of radiation received on a vertical surface facing South on cloudless days for all days of record; also average monthly values of cloudiness in tenths of sky cover.

the radiation on the North wall consists entirely of diffuse sky and ground reflected radiation.

Conversely, during the warmer part of the year when the North wall is receiving direct radiation, there is no direct radiation impinging on the South wall. At this time only diffuse sky and ground reflected radiation are received, and when the sun, in its diurnal march, arrives south of east and remains south of west, direct, diffuse and ground reflected radiation are recorded on the South walls. Finally, after the sun has passed to the north of west (270 degrees azimuth), diffuse sky and ground reflected radiation once again are the only components measured by the pyrheliometer facing South. During the colder half of the year when the sun rises south of east and sets south of west, direct, diffuse and reflected ground radiation impinges on the South wall for the duration of the solar day.

A series of graphs have been constructed showing average radiation values received for various cloud conditions throughout the year. Tables for average monthly values, along with frequency distributions for radiation values on the North and South vertical surfaces, are included.

Tables 1 and 2 present the mean annual frequency distribution of radiation as received on the vertical surfaces facing North and South respectively. The radiation received on the North surface is confined to only three class intervals, whereas that on the South surface is spread over seven classes. On the North surface the majority of days (65%) lay between 0 and 100 langleys, while the largest number of days (27%) on the South vertical surface were in the 200 to 300 langley class. On only two days of the year, one each in June and July, did the radiation on the North vertical wall exceed 200 langleys, whereas on 228 days or 62% of the year radiation on the South surface exceeded this amount.

Figure 2 is composed of two graphs of North vertical radiation. One, constructed from the values in Table 3, represents the monthly averages of daily values for the period of record for all types of sky conditions. The values range from a maximum of 157 langleys in June to a minimum of 40 in January and December. Absolute

TABLE 1 — MEAN NUMBER OF DAYS PER YEAR WITH RADIATION FALLING, IN GIVEN INTERVALS, ON A VERTICAL SURFACE FACING NORTH

Interval, Langleys per day	Month													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
	Days per year on North vertical surfaces													
0-100	31	26	26	20	6	2	2	8	25	30	30	30	236	65
100-200	0	2	5	10	25	27	28	23	5	1	0	1	127	35
200-300	—	—	—	—	—	1	1	—	—	—	—	—	2	0

TABLE 2 — MEAN NUMBER OF DAYS PER YEAR WITH RADIATION FALLING, IN GIVEN INTERVALS, ON A VERTICAL SURFACE FACING SOUTH

Interval, Langleys per day	Month													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
	Days per year on South vertical surfaces													
0-100	13	8	9	7	6	3	2	4	5	6	9	9	81	22
100-200	3	3	4	5	7	7	8	5	4	3	3	4	56	16
200-300	2	3	3	6	15	20	21	14	5	3	4	4	100	27
300-400	3	3	4	9	3	—	—	8	9	5	5	5	54	15
400-500	4	4	7	3	—	—	—	—	7	9	5	5	44	12
500-600	5	6	3	—	—	—	—	—	—	5	4	3	26	7
600-700	1	1	1	—	—	—	—	—	—	—	—	1	4	1

TABLE 3 — MONTHLY MEAN VALUES OF SOLAR RADIATION RECEIVED ON A VERTICAL SURFACE FACING NORTH

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Langleys per day on North vertical surfaces											
1949	—	—	—	—	—	—	129	96	70	52	33	30
1950	26	61	77	79	113	161	140	105	75	58	40	35
1951	42	54	70	96	124	148	149	114	77	60	42	38
1952	40	63	72	81	122	154	147	106	83	64	44	34
1953	38	53	58	81	120	158	144	121	115	74	69	56
1954	56	57	75	92	126	166	165	108	77	59	40	45
1955	40	55	71	77	134	145	147	103	83	56	41	39
1956	38	63	89	98	128	165	155	124	—	—	—	—
Mean	40	58	73	86	124	157	147	110	83	60	44	40

TABLE 4 — MONTHLY MEAN VALUES OF SOLAR RADIATION RECEIVED ON A VERTICAL SURFACE FACING SOUTH

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Langleys per day on South vertical surfaces											
1946	—	—	—	—	—	—	268	204	263	370	263	222
1947	270	312	324	233	180	207	212	233	291	403	282	347
1948	223	362	283	248	183	177	215	261	354	255	242	247
1949	211	284	287	224	207	230	211	243	270	339	220	290
1950	190	214	358	211	208	219	217	232	249	341	252	231
1951	243	264	198	257	218	178	211	230	300	268	265	267
1952	237	307	228	236	218	230	251	228	289	324	230	198
1953	212	291	231	190	172	217	211	255	319	257	264	280
1954	193	287	301	216	181	193	221	239	212	284	28[illegible]	216
1955	336	275	298	225	244	205	241	225	322	284	316	320
1956	238	319	287	235	191	210	192	193	249	—	—	—
Mean	235	292	280	228	200	207	223	231	284	313	262	262

minimum and maximum average monthly values were 26 langleys in January of 1950, and 166 langleys in June of 1954.

It is very difficult to explain the apparent hump in the curve for the month of February. One possible explanation is the large number of days in which snow covers the ground, increasing the amount of radiation reflected from the ground. The trace depicting cloudless day radiation is indicative of the annual march of the sun, with sharp rises between March and September due to the direct radiation which impinges on the bulb at this time of the year.

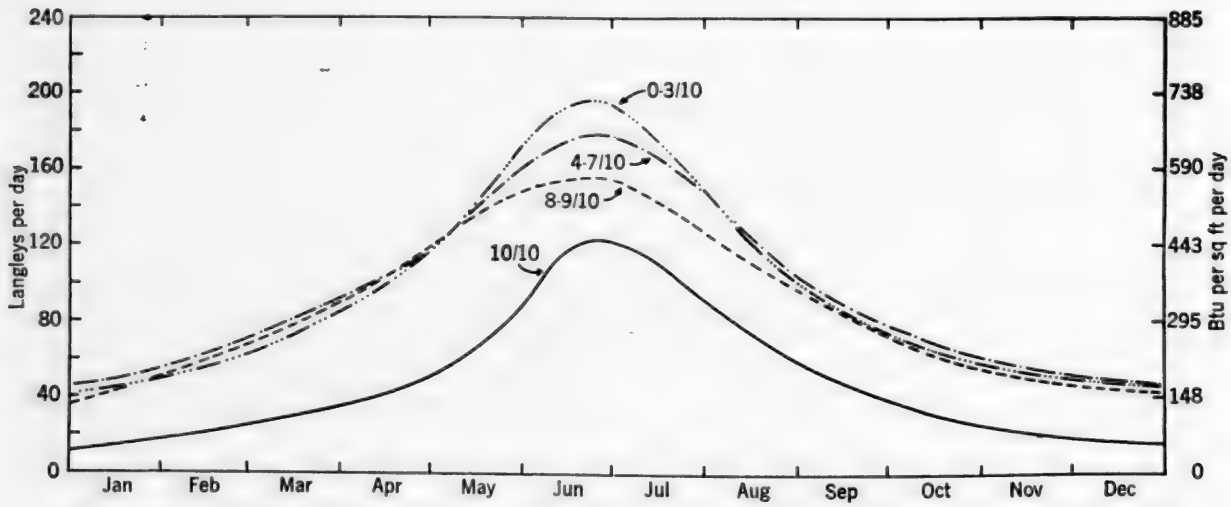


Fig. 4. Average monthly values of radiation received on a North vertical surface for various cloud amounts.

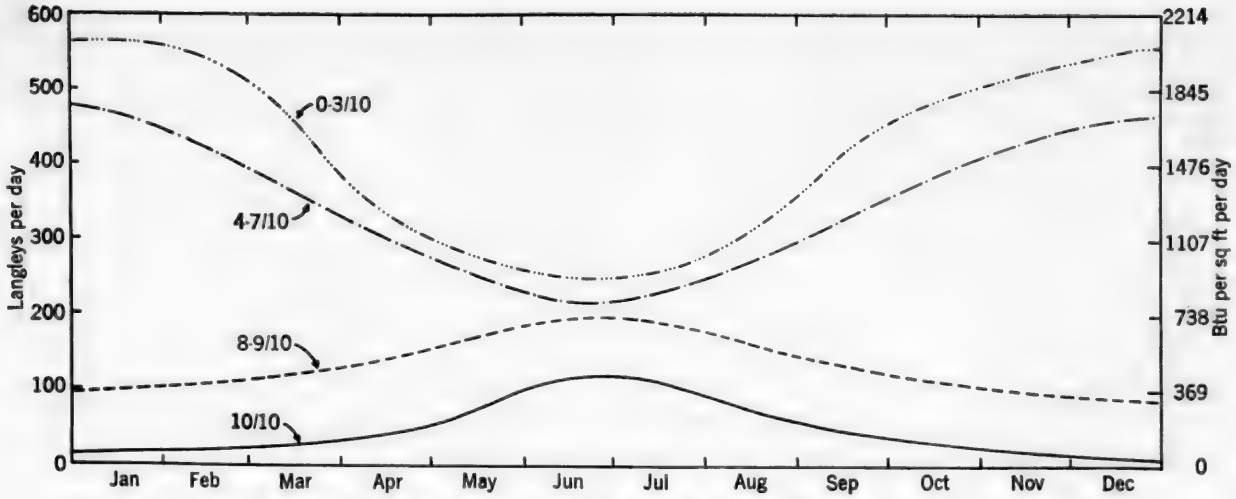


Fig. 5. Average monthly values of radiation received on a South vertical surface for various cloud amounts.

The two graphs in Fig. 3 represent the monthly averages of daily values for cloudless skies and for all types of sky conditions for radiation received on the vertical surface facing South. A trace of the overage cloud cover for the past 70 years is also included.

Observation indicates a close inverse correlation between cloud cover and radiation received on a vertical surface facing South. Peak values of radiation and minimum values of cloud cover occur in October, with secondary peaks and minimums in February. Minimum values of radiation and maximum values of cloudiness occur in May. During cloudless days the trace for radiation on the South vertical surface shows peak values on the order of 570 langleys in January, and minimum values of 250 langleys in June. A more favorable angle of incidence during the winter months causes this annual progression.

Figure 4 comprises representative traces of radiation received on the North vertical surface for varying cloud amounts. It was not possible to discriminate between cloud types because of the lack of sufficient data. There is very little difference in the amount of radiation received on the North wall for cloudiness values up to 9-tenths for 9 months of the year. During the summer months the peak values are indicative of the receipt of direct radiation and the longer solar day, while overcast sky conditions show markedly reduced values. These overcast sky condition peaks during the summer months reflect the longer solar day.

In Fig. 5, which gives traces of South vertical radiation for various cloud amounts, the normal progression of traces occurs up to and including sky conditions of 7-tenths of cloudiness. That is, these values are influenced by the solar elevation angle. When values of 8-, 9- and 10-tenths of cloudiness are used, there is a marked change in the curve which shows a variation compatible with a longer solar day and diffuse radiation exclusively, rather than a more favorable solar elevation angle.

Table 5, indicating the attenuation of solar radiation with different cloud amounts, was constructed from Fig. 4 and 5. Using the 0 to 3-tenth cloudiness radiation values as 100 percent indices, values for other sky conditions during the winter and summer were related to these indices.

An outstanding feature of this table was the increase by 12% of the 4- to 7-tenths trace over the 0 to 3-tenths trace of the North vertical surface. This increase most likely was caused by the increase in the diffuse component. Overcast skies depleted the radiation on the South vertical surface by 97% during the winter season. This was primarily due to the attenuation of all the direct radiation and a large portion of the diffuse component.

TABLE 5 — PERCENTAGE SOLAR RADIATION ON VERTICAL SURFACES FACING NORTH AND SOUTH FOR VARIOUS CLOUD CONDITIONS, USING ZERO TO THREE-TENTH SKY COVER VALUES AS BASES

Surface	Tenths of sky cover			
	(0-3)	(4-7)	(8-9)	(10/10)
	Winter			
North Vertical	100	112	90	25
South Vertical	100	83	16	3
	Summer			
North Vertical	100	91	79	62
South Vertical	100	88	80	48

In the previous article by the author, "Solar Radiation on Walls Facing East and West," in the October, 1958 issue, data in the last two columns of Table 5, on page 88, were inadvertently switched. Values of percentage radiation appearing below the column heading "Fig. 11" are actually those that belong under the column heading "Fig. 12," and vice versa.

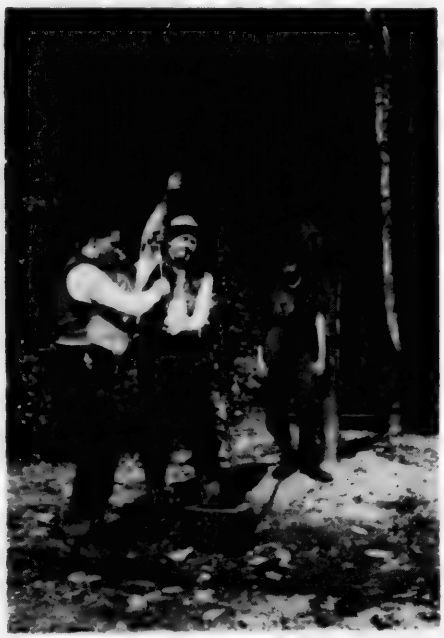
References

1. Preliminary Measurements of Solar Energy on Vertical Surfaces, Hand, I. F. *Transactions, American Geophysical Union*, Vol. 28, No. 5, October, 1947.
2. Solar Radiation on Walls Facing East and West, Cunniff, C. V. *Air Conditioning, Heating and Ventilating*, Vol. 55, No. 10, pp. 82-88, October, 1958.

▲ What dinner can be like in a non-air-conditioned home on a hot evening is dramatized in this scene from "Mother Knows Best," an 18-min color movie produced by Minneapolis-Honeywell Regulator Co. At right, Academy Award winner Jane Darwell is cast in the role of a crotchety mother-in-law in the film which is designed to promote residential central air conditioning among America's millions of housewives. Primary use of the film will be made by organized industry groups who have already established means of reaching large consumer groups. In addition, Honeywell will make the movie available, either on a loan or sale basis, to all segments of the industry.

Picture Paragraphs

▼ An educational sound-color strip film, entitled "Insulating With Plastic," has been produced by the Armstrong Cork Co.'s Insulation Division. The 35-mm film, which runs about 18 min, traces the recent development of flexible, foamed plastic insulation, describes its properties, and shows a number of application techniques used in actual installations throughout the country. The scene below is one of 45 case histories which show all kinds of jobs in the air conditioning, refrigerating, plumbing and heating fields. The film, of a non-commercial nature, is available to any interested groups through all Insulation Div. field offices and the home office in Lancaster, Pa.



▲ Three feet down was a good day's drilling with a springpole rig, and it was all hard work. This scene from "These Are My People," a new color motion picture produced for The Columbia Gas System, Inc., New York, N. Y., recreates a historical event of 1815. Along the banks of the Kanawha River near Charleston, W. Va., salt brine drillers unexpectedly struck natural gas, possibly the first discovery of natural gas in the United States. Film goes on to tell the story of the natural gas industry up to the present day.

Achieving economy in the

Design and Use of Heat Pumps

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Engineer, York Division, Borg-Warner Corp., York, Pa.

A few years ago, the air source heat pump was considered an experimental curiosity; today, it is a recognized method of maintaining year-round comfort conditions in nearly all types of buildings. Through suggested steps in design and operation of the heat pump, it is possible to obtain appreciable savings. Methods of design and operation are considered for various types of systems, with information on air distribution, compression, defrosting methods and controls.

MANY new developments, in recent years, have led to the acceptance of the air source heat pump as a practical and economical method of providing year-round comfort conditioning in buildings used for many purposes. These developments have been well defined in numerous technical publications and consequently, will not be repeated here.

Because of the large number of heat pump installations, it is important for engineers in the heating and cooling industry to become better acquainted with the important factors involved in applying heat pumps properly, recognizing both advantages and limitations.

Water Source Versus Air Source

Water source heat pumps have been used in this country dating back to at least the early thirties and, for the most part, have operated quite successfully. The growth of the water source system has been relatively slow. It has been surpassed by the air source, which only had its infancy, except on an experimental basis, in the years following World War II.

The reason for the slow growth of the water source is simple. There are few populated areas abounding with generous supplies of clean water at sufficiently high temperature levels. In most areas, the lowering of the water table and increased water demands for other purposes have left this type of heat pump with an extremely limited market. Disposal of the water also becomes a problem, with many communities charging high sewer rents.

Another problem is water quality. Soluble minerals such as calcium salts, magnesium salts, and iron will deposit themselves on heat exchanger surfaces and retard heat transfer. Water without some mineral content (soft water) is not ideal, for corrosion is accelerated. A neutral water supply with a pH value of 7.0 is seldom found.

Unlike the air source heat pump, the water source does not reverse the refrigerant cycle (except the water-to-air variety), but the water flow through the heat exchangers is reversed by automatically operated valves. Therefore, whenever the system operation is reversed from heating to cooling or vice versa, the indoor conditioned water circuit becomes contaminated with water supplied from a well, or lake, or even sea water in more southerly climates. This condition aggravates the water treating problem of the conditioned water circuit which is exposed to each air handling unit coil throughout the building.

Treatment of the supply water from the heat sink be-

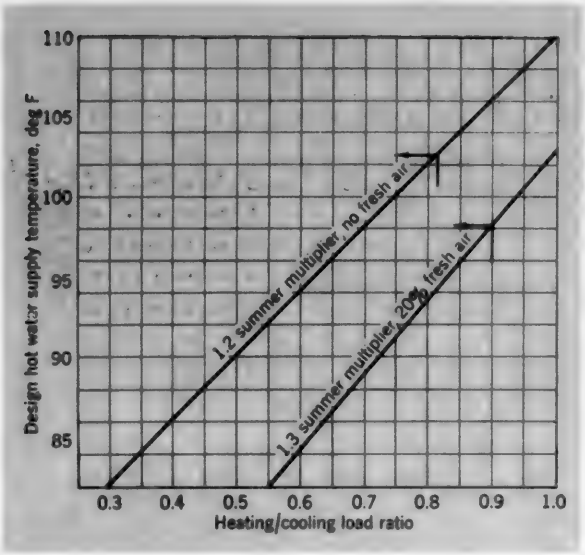


Fig. 1. Conditioning coil hot water temperature requirements for coils sized for summer cooling.

comes impractical because of the large quantities involved. The result is that unless the water available is ideal, a maintenance problem is encountered, requiring periodic cleaning of the heat exchange surface and improved and more elaborate water treating devices for the so-called closed water circuit to the conditioning coils. Acidic water will shorten the life of the equipment.

Another problem in some areas is the sand content in the well water which, if not completely separated from the water supplied to the system, can greatly shorten the life of the pumps, heat exchangers, and valves. Increased maintenance of the equipment of the system is also required.

The water source heat pump, however, does have several advantages. The yearly electrical operating costs will, except in rare circumstances, be substantially lower than for any of the commonly used fossil fuels in industrial and commercial establishments. The electrical consumption required will also be less than that of the air source heat pump for year-round operation due to the more efficient refrigeration cycle.

A further advantage is that the first cost of the system generally will be lower than a conventional heating system provided with a second system for summer cooling. It will also be slightly lower in first cost than an air source heat pump.

In brief, the water source heat pump can be justified in first cost and operating cost if an abundant supply of approximately 50 deg F or warmer water is available, free from foreign matter, and not conducive to excessive corrosion or scale buildup on heat transfer surface.

The air source, on the other hand, has no limitation on the availability of a heat source-sink, as air is with us everywhere on the face of the earth. Since this type requires more power per unit heat output at lower outside air temperatures, it is merely a question of economics whether or not the heat pump can be justified in a given location. Many water problems inherent with the water source type are non-existent when air is the source of heat. It is for these reasons that most equipment manufacturers and electric utilities have concentrated their efforts on the development and application of the air source heat pump.

Water Temperature for Heating

In the years when summer air conditioning was practically unknown, water heating coils were selected for hot water supply temperatures from 140 to 200 deg with steam coils designed to operate at even higher temperatures. Obviously, the larger the temperature split between the supply water or steam and the heated air, the smaller and more economical may be the coil selection.

In later years, when summer cooling became popular, the conditioning coil selection was based on: summer duty, dictated by dry bulb and relative humidity requirements; acceptable human comfort diffusion ranges; awareness of freeze-up hazards; and economical first and operating costs. Supply water temperatures to the conditioning coils generally fall between 42 and 48 deg, thereby requiring considerable larger coil surfaces than needed for heating.

Even today, many buildings or portions of buildings are not cooled during the summer, or separate coils may be used for heating purposes. Present-day practices of supplying high temperature water or steam to coils used for heating only is justifiable, if precaution is taken to prevent overheating during mild weather.

The heat pump only becomes competitive with conventional fossil fuel fired heating systems when summer cooling is also to be provided. Installation of a heat pump for winter heating only can seldom be justified, due to the higher first cost of the equipment over a furnace or boiler. It does become competitive, however, when cooling is required since most of the equipment must be provided for the cooling duty with the same equipment used for heating during the winter.

Therefore, when a heat pump is applied to an installation, the air handling unit coils will generally be selected for the summer requirement to provide design dry bulb and relative humidity requirements at the heaviest summer load condition. The same coil will seldom require water temperatures above 110 deg for heating, even with outside air temperatures as low as minus 10 deg.

Figure 1 illustrates typical coil performances, showing hot water supply temperature requirements when coils are initially selected for the summer cooling requirement. The water temperatures are expressed as a function of the heating-to-cooling load ratios in a perimeter room of a commercial or industrial building. The ratio is found by dividing the winter heating load in Btu per hour by the summer cooling load (sensible plus latent) in Btu per hour. For the most part, this ratio falls within the range of about 0.4 to 0.9 for most office building perimeter rooms.

The upper curve shows the warm water temperature requirements when the coil is selected for the summer duty with no fresh air supplied to the unit and a 1.2 coil multiplier (total load divided by sensible load). This would represent an installation where fresh air is supplied to the conditioned spaces through a separate interior supply system.

The lower curve is for a conditioned space where 20% of the circulated air is ventilation, and the summer multiplier at the design condition is 1.3. Here it can be noted that even lower water temperatures are adequate

during the coldest days of the year since a mixture of outside air with return air will lower the entering air temperature to the heating coil.

From these curves it can be seen that reversible industrial heat pump systems seldom require water temperatures in excess of 110 deg when used for space-comfort conditioning.

Unnecessarily high water temperatures penalize the efficiency of a heat pump system since higher refrigerant condensing temperatures require increased compressor horsepower. Figure 2 represents some performance characteristics of a compressor on an air source heat pump system at selected supply water temperatures to the heating system, and with variable outside air temperatures. Supplying 140 deg water to the heating coils on a 20 deg day when only 105 deg water is required, would increase the electrical consumption to the compressor motor by approximately 36%. On a day when the outdoor air temperature is 50 deg, supplying 140 deg water when only 105 deg is needed would increase the compressor motor electrical consumption approximately 60% for the same heat output.

When excessive water temperatures are provided, a control problem is encountered at the air heating coils since they will be oversized on even the coldest days. For instance, a year-round conditioning coil selected for the summer cooling duty and supplied with 140 deg water from the boiler on a 0 deg day when only 105 deg water would be sufficient, will require throttling of the water valve to about 12% of its rated capacity to prevent over-heating. On a day when the outdoor air temperature level is about 50 deg, the same throttling valve will have to choke back the water quantity through it until only about 3.5% of its design summer gpm would flow through the coil to prevent overheating.

The rangeability of most water throttling valves used for this purpose is limited and when exceeded will result in a hunting condition. The outcome is deviations in controlled air temperature with some sacrifice in human comfort within the conditioned space.

Should excessively high water temperatures be provided to conditioning coils equipped with face and bypass dampers, the temperature control within the space would suffer even more with a natural tendency toward overheating on mild days. Cyclic operation of the air circulating fans would also provide sporadic control of the air temperature, and furthermore, would provide hot spots in the room because of the poor air distribution during the off-cycle. On milder days, this may represent 95% of the time. Even on the "off-cycle", with the coil located to permit thermal circulation, the conditioned space would again likely become overheated during mild weather, even with the fan off.

Savings in Heating

It follows that if 105 deg water is sufficient when heating on a 0 deg day, even lower water temperatures are ample when the outside temperature is warmer. A coil selected for this condition would likely have sufficient heating capacity on a 60 deg day when supplied with 80 deg water.

As evidenced from the curves of Fig. 2, any reduction in supply water temperature will show a further savings in operating cost. The lowest curve of Fig. 2 represents the compressor electrical consumption at various outdoor air temperatures when the hot water supply temperature is programmed from 105 deg water at 0 deg outdoor air temperature, to a minimum of 80 deg water when the outside temperature is 60 deg. This compares favorably with the curve showing consumption when the supply water temperature is maintained at a constant 105 deg. Thus, if supply water temperature from the heat pump system is programmed inversely with outside air temperature to provide sufficiently warm, but not overheated water, the ultimate in low operating costs and high degree of comfort can be reached.

An analysis was made for the city of Philadelphia to determine the savings in operating costs that might be realized on a heat pump system with water temperature programmed versus one arranged to provide a constant supply water temperature. Weather data used were 0 deg winter design temperature, 4523 degree-days, and 5405 heating hours per year. The result was that the system supplied with a constant 105 deg heating water temperature required 28% more compressor motor kw hours than an identical heat pump with the water temperature programmed from 105 deg at 0 deg outdoors, to 80 deg when the outside air is at +60 deg. Furthermore, additional savings would be realized on any electrical demand charge with the programmed water temperature system.

Air Distribution

Nearly any type air distribution system used for summer air conditioning, will lend itself to year-round operation with the heat pump. Some of the more common are the under-the-window fan-coil type, central or zone

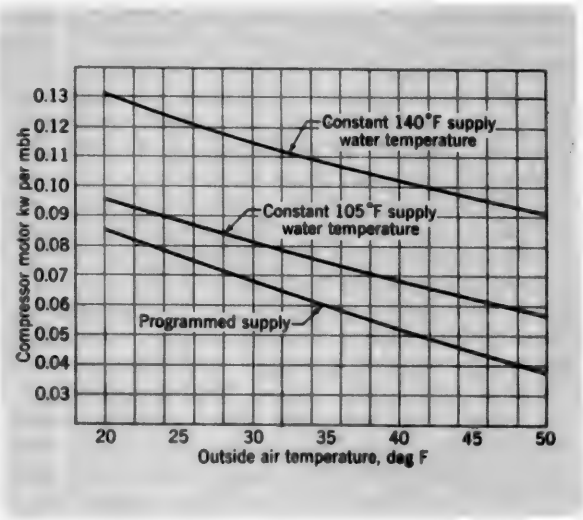


Fig. 2. Compressor operating performance at different supply water temperatures to heating system.

units, and dual duct systems. The use of a 3-pipe system with high velocity induction units also offers an arrangement that provides both operating economy and great flexibility.

A central ventilation supply system is frequently provided to the building or to each zone rather than at the

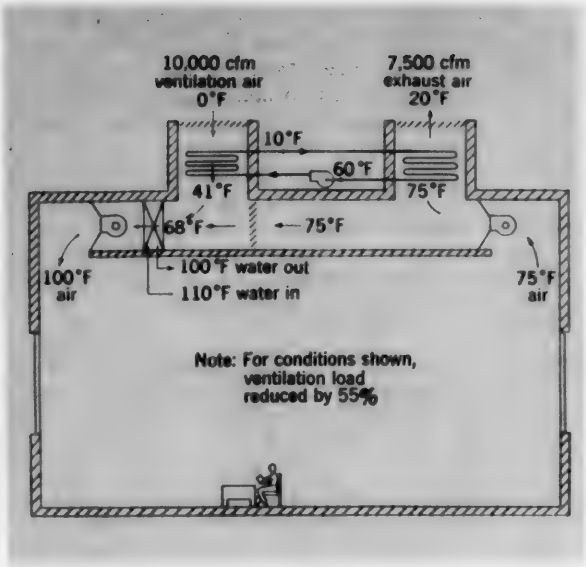


Fig. 3. Reduction in heating load by run-around system.

individual room units. This is preferred since control of the ventilation air quantity can be economically regulated at centralized locations. It has the advantage that increased quantities of outside air may be provided during intermediate seasons to do useful cooling, reducing the mechanical refrigeration required. Also, the fresh air quantity can be reduced or cut off during the heating season when the building is not occupied. This is particularly important for office buildings, department stores, banks and churches where the number of unoccupied hours generally exceed the occupied hours. Since the ventilation air preheating load usually represents between 30 and 70% of the commercial and industrial building heating requirements, a considerable savings will result when provision is made to render the ventilation supply inoperative whenever the building is not occupied.

On some installations, the ventilation air quantity is reduced at lower outside air temperatures on the premise that the building will be occupied by fewer people. Particularly applicable are the department stores where statistics reveal that fewer people will venture from their homes on extremely cold days, thereby reducing the number of occupants in a store. The Dayton's Southdale Shopping Center outside Minneapolis, Minn., is conditioned by a water source heat pump which was designed to provide 120,000 cfm of ventilation air whenever the Center is occupied at an outdoor air temperature of +15 deg or higher. At lower temperatures, the air quantity is programmed directly with the outside air temperature to provide a minimum of 60,000 cfm when the outside air is at the design point of −20 deg. This is a practical design and merits consideration where outdated local codes do not prohibit it.

On most large commercial and industrial buildings, a positive means of exhausting air from the building is mandatory to obtain good air distribution. Exhausting this air at one or more central points may be advantageous from the standpoint that heat may be extracted from it. One economical method of removing this heat and returning it to portions of the building requiring heat, is by the use of a direct expansion coil located in the exhaust air stream. Such an arrangement was used on the installation at the Columbus and Southern Office Building, Columbus, Ohio, where a 550-ton air source heat pump was used.

Another method of extracting this heat for beneficial use is by means of the "run-around" system, illustrated in Fig. 3. Coils are located in both the ventilation supply and exhaust air ducts with a non-freeze solution such as ethylene glycol circulated between the two coils. Heat is removed from the exhaust air and absorbed by incoming ventilation air to provide a reduction in heating requirements of the mechanical equipment. Care should be exercised in the design of the run-around system to prevent excessive frost formation on the coil in the exhaust air stream. A by-pass valve, thermostatically controlled, can be located in the anti-freeze solution piping circuit to maintain solution temperatures not lower than approximately 28 deg to the exhaust air coil as a means of preventing the formation of frost.

Still another method is to permit frost accumulation on the coil surface and periodically shut down the circulating pump when defrosting is necessary. The frost can then be removed by circulating warm exhaust air over the coil surface.

Compound Compression

One limitation of the air source heat pump is that as lower out-door air temperatures are encountered, the efficiency of the system decreases. This disadvantage is greatly offset by providing compound compression at lower outside temperatures when the pumping differential pressure across the compressors becomes high. Compound compression is a means of pumping gas through several stages of compression to limit the pressure differential and compression ratio across each stage. Two-stage compression reduces the average pumping differential across each compressor by approximately 50% and decreases the compression ratio by approximately 67%.

By using compound compression, two things are accomplished toward improving system efficiency. First, the theoretical refrigeration cycle is greatly improved, since only about 75% of the total refrigerant flow need be pumped by the low stage compressor with the remaining 25% pumped by only the high stage. This is made possible by the use of an intercooler which expands some of the refrigerant to intermediate pressure while subcooling the liquid refrigerant flowing to the evaporator. Secondly, the volumetric efficiency of the reciprocating type compressor varies inversely with the compression ratio. When the compression ratio is reduced 67%, a sizable gain in compressor volumetric efficiency results.

Typical figures indicate that two-stage compression can produce about 65% more heat at −20 deg evaporator temperature than can the same displacement compressors operating single stage. Furthermore, the electrical requirement for the single stage compressors would be approximately 65% greater than for the two-stage for each unit of heat output.

Figure 4 shows a schematic diagram of the refrigeration cycle which can operate single stage with gas flow in parallel for summer cooling, and can be converted to compound compression with series gas flow to improve the operating efficiency at lower outside air tem-

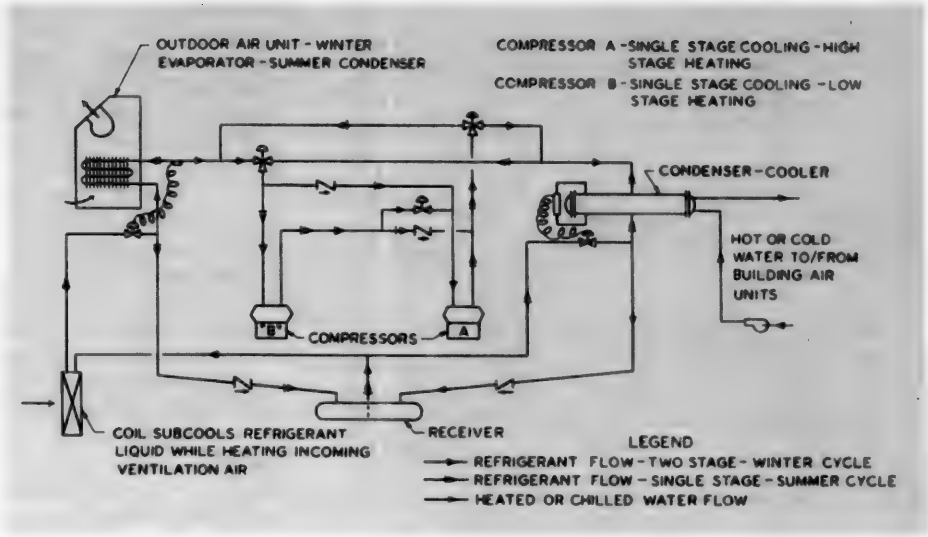

OUTDOOR AIR UNIT - WINTER EVAPORATOR - SUMMER CONDENSER
COMPRESSOR A - SINGLE STAGE COOLING - HIGH STAGE HEATING
COMPRESSOR B - SINGLE STAGE COOLING - LOW STAGE HEATING
CONDENSER - COOLER
HOT OR COLD WATER TO/FROM BUILDING AIR UNITS
"B"
COMPRESSORS
A
COIL SUBCOOLS REFRIGERANT LIQUID WHILE HEATING INCOMING VENTILATION AIR
RECEIVER
LEGEND
REFRIGERANT FLOW - TWO STAGE - WINTER CYCLE
REFRIGERANT FLOW - SINGLE STAGE - SUMMER CYCLE
HEATED OR CHILLED WATER FLOW

Fig. 4. Air source heat pump with series-parallel arrangement of compressors provides compound compression when outside air temperature is low.

peratures. This is accomplished by providing a single automatically operated gas valve plus two check valves.

Thus, if the ratio of heating load to cooling load is favorable, the same compressors used for summer cooling may provide sufficient capacity, when compounded, for outdoor air temperatures of even −10 deg without the use of supplementary electric heaters.

A typical application is the Columbus and Southern Electric Company office building where the winter design temperature in Columbus, Ohio is −10 deg. Three reciprocating type compressors are arranged on each of two systems to provide 275 tons summer cooling. At lower outside temperatures during the heating season, two of the three compressors become boosters, discharging gas to the single high stage compressor. Consequently, no standby compressors are required for either the peak summer cooling load or the winter heating load of 2,200,000 Btu per hr.

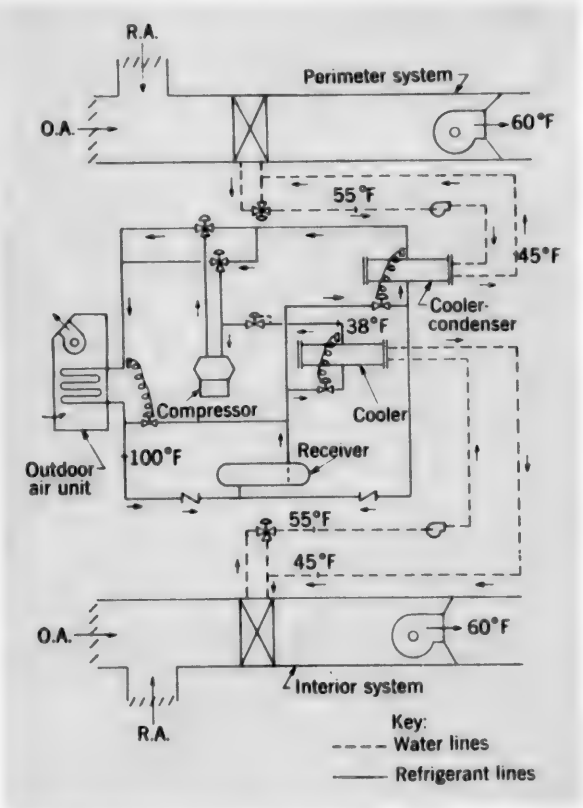


Fig. 5. Air source heat pump on low pressure air system with interior zone. Outside air above 60 deg.

On larger installations, the use of both centrifugal and reciprocating type compressors may be desirable. A reciprocating compressor is used for its inherent characteristics of wide flexibility for different temperature and pressure conditions, ability to unload to low capacities on mild days, and wide operating range with little sacrifice in efficiency.

The centrifugal compressor has the ability to handle large tonnages, requiring less floor space and offering lower installed cost per ton of refrigeration on larger systems. When the two types of compressors are used together, the reciprocating compressor provides the flexibility desirable for year-round operation and the centrifugal compressor makes available the large capacities required, particularly during the peak heating and cooling seasons. These two compressors can be operated in parallel for summer mechanical cooling, and can be compounded during the winter at lower outdoor air temperatures, with the centrifugal compressor serving as the low-stage machine.

Alexander's Department Store in Rego Park, Long Island, advertised as the world's largest apparel store, has an 820-ton heat pump installation containing two identical systems. Each system has a 280-ton centrifugal compressor and a 130-ton reciprocating compressor which are adequate for handling the maximum summer cooling load and when compounded for winter operation, provide the 3,350,000 Btu per hr heating that is required on a 0 deg day.

Complete Utilization of Heat

On many larger buildings, interior rooms require cooling throughout the year due to the heat given off by the lights and occupants, plus the absence of an exposed

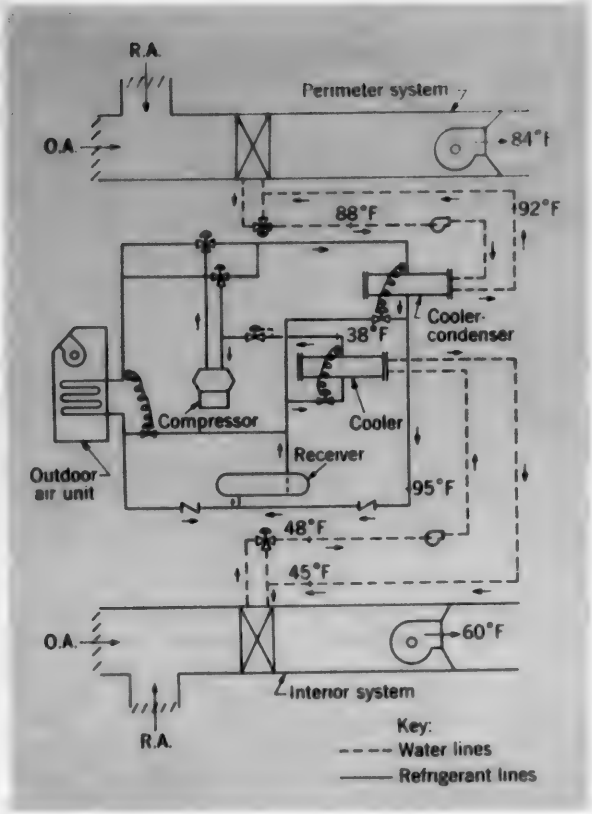


Fig. 6. Air source heat pump on low pressure air system with interior zone. Outside air between 30 and 60 deg.

perimeter to reject the heat. Such a building offers an excellent source of heat which can be captured efficiently by the heat pump system and rejected to the building perimeter where heat is required during the winter heating cycle.

One heat pump system which will adapt itself to this type of building to provide flexibility and economy is illustrated in Figs. 5 through 8. Figure 5 shows the cycle during the summer cooling season when outdoor air temperatures above 60 deg are experienced. Although separate perimeter and interior air handling systems are provided, both require mechanical cooling for this condition of operation. The refrigerant positioning valves permit the two indoor heat exchangers to serve as evaporators, removing heat from the water circulated to both air handling systems. This heat will then be rejected to the outdoor air via an evaporative type or air cooled condenser.

Operation during the intermediate season is shown in Fig. 6. When the outside air temperature is between perhaps 30 and 60 deg, cooling will be required in the interior zone and heating around the perimeter, with the heat absorption from the interior zone equalling or exceeding that required in the perimeter. Consequently, the refrigerant can absorb heat from the water circulating through the interior system air handling coil and this heat, plus the work input to the compressor, can be rejected to the other indoor heat exchanger with warm water circulated to the perimeter system. The compressor capacity is regulated by the heating requirement and additional cooling is provided to the interior system by modulating the fresh air dampers to provide increased quantities of air to effect cooling. During this cycle of operation, the outdoor air unit is inoperative and the compression system operates at a high evaporator temperature in removing heat from within the building, offering a very high efficiency.

As the outside temperature falls below 30 deg, additional heat may be required to supplement that from the interior zone, and this is readily available from the outdoor air at a lower temperature, Fig. 7. Here the fresh air damper to the interior system is positioned for the minimum quantity and the compression system continues to remove heat available from the interior of the building. The outdoor air unit operates as an evaporator to remove additional heat from outside air to satisfy the total building heating requirement. To simplify the illustration, single stage compression is shown. On compound compression systems, even greater efficiencies are made available by introducing refrigerant evaporating in the water cooler to the high stage compressor, with only the refrigerant vapor in the outdoor air unit, at a lower temperature, flowing through the low stage or booster compressor.

Load Analysis

A graph, Fig. 8, indicates the respective heating and cooling loads versus outdoor air temperatures from 0 to 95 deg. Note that on a day with a temperature of 30 deg, the heat absorption from the interior system

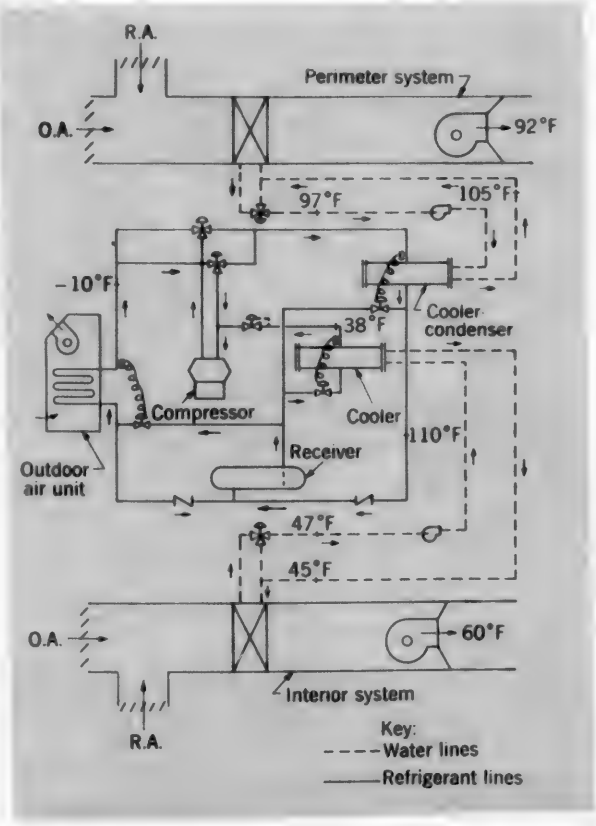


Fig. 7. Air source heat pump on low pressure air system with interior zone. Outside air below 30 deg.

plus the heat of compression is equal to the load required by the perimeter of the building. Therefore, at any higher temperature level, the heat available from the interior system will exceed the perimeter zone heating requirements, permitting the use of additional quantities of fresh air to effect cooling in the interior spaces of the building.

On many large buildings, this balance point may be at an even lower outside air temperature, sometimes resulting in an interior heat rejection rate greater than the maximum perimeter heating requirement.

A similar arrangement is shown in Fig. 9, as it would apply to a double duct air handling system. Here both the indoor cooler and the indoor condenser are nonreversible. During the summer cycle, chilled water from the water cooler removes heat from the cold duct. The refrigerant vapor formed in the cooler is compressed and discharged to both the indoor condenser and the outdoor air unit serving as a condenser. Water circulating to the indoor condenser absorbs heat to make it available in the warm duct so that both cool and warm air is available at each mixing box.

When operating on the intermediate cycle, the outdoor air unit may be idle. Sufficient heat is removed from the cold duct by the indoor water chiller to satisfy the heating requirement of the warm air duct system. Any additional cooling required is supplied by increasing the quantity of outside air. For the winter cycle, the outside air dampers are positioned for minimum ventilation and the outdoor air unit operates as an evaporator to remove heat from outside air to supplement that from the indoor chiller. When compound compression is used, only the refrigerant vapor from the indoor water cooler is introduced directly to the high stage compressor, at lower outside temperatures, and the refrigerant from the outdoor evaporator flows first to the booster compressor.

High Velocity Air

Further illustrating the flexibility and economy of the heat pump is the high velocity air handling system arrangement shown in Fig. 10. For intermediate seasons of between perhaps 40 and 65 deg outside air, chilled water is required for cooling and dehumidification of the interior system, the perimeter system, and the individual induction units, while reheat is necessary in the perimeter system. This is made possible by the use of an auxiliary condenser which functions in parallel with the outdoor air unit when serving as a condenser. Water circulating to the auxiliary condenser absorbs as much heat as is required for reheating in each zone, while the excess condenser heat is rejected to the outside air. The use of the auxiliary reheat condenser is also applicable on nearly any heat pump system where reheat would be desirable in conjunction with mechanical cooling.

Numerous other building functions and system applications offer means of economically capturing heat from within by a heat pump system. Telephone exchanges, calculating and tabulating machine rooms, and others generate considerable quantities of heat which must be removed to maintain expensive equipment at the necessary temperature level, in addition to providing the comfort necessary for the occupants. Another source is in industrial plants where heat is removed from process work, friction-generating equipment and exhaust fumes. Even

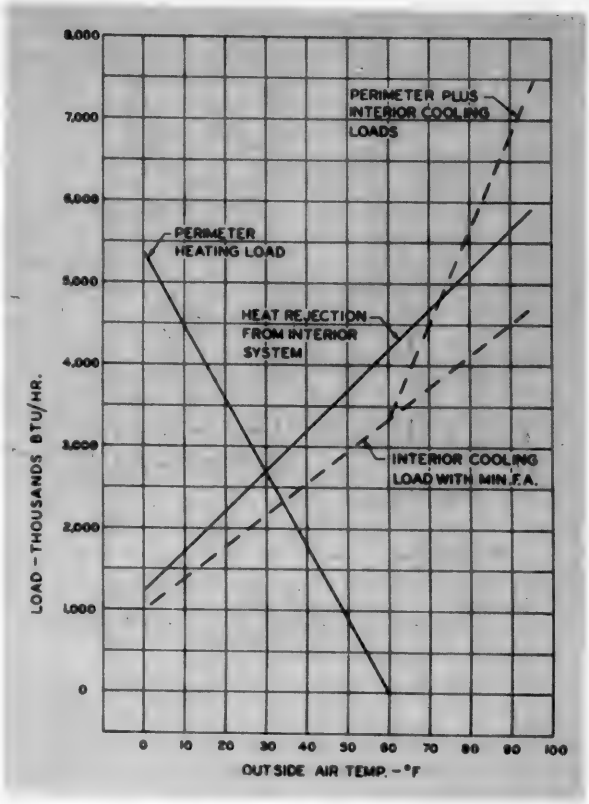


Fig. 8. Typical load analysis.

another is the recovery of heat from refrigeration condensing units or packaged air conditioners. Heat from these sources is generally discarded to the atmosphere but may be economically captured by the heat pump system and made available where heating is necessary.

Refrigerant Liquid Subcooling

Another method of reducing the compressor motor electrical consumption is to locate a refrigerant liquid subcooling coil in the ventilation air plenum chamber, which provides preheat to the incoming fresh air while subcooling the liquid refrigerant as it flows to the evaporator. On single stage systems, this arrangement also provides an increase in heating capacity for a given displacement compressor. In effect, useful subcooling of the refrigerant liquid increases the refrigeration effect of each pound circulated to the evaporator, thereby reducing the quantity of refrigerant that the compressor must handle to absorb a given amount of heat. The horsepower is also reduced for each unit of useful work in the same proportion that the flow rate may be decreased.

Other means of subcooling the liquid refrigerant, such as disposing of the heat to the outdoor air, or by preheating the air circulated to the outdoor evaporator, would actually result in a net loss over a conventional system without subcooling and should not be used. Rejecting this heat to the outside air would be wasteful. Preheating air at the outdoor evaporator coil raises the air temperature a small amount in proportion to the quantity of heat given up by the system.

The use of subcooling coils is limited in application to buildings where a large portion of the ventilation sup-

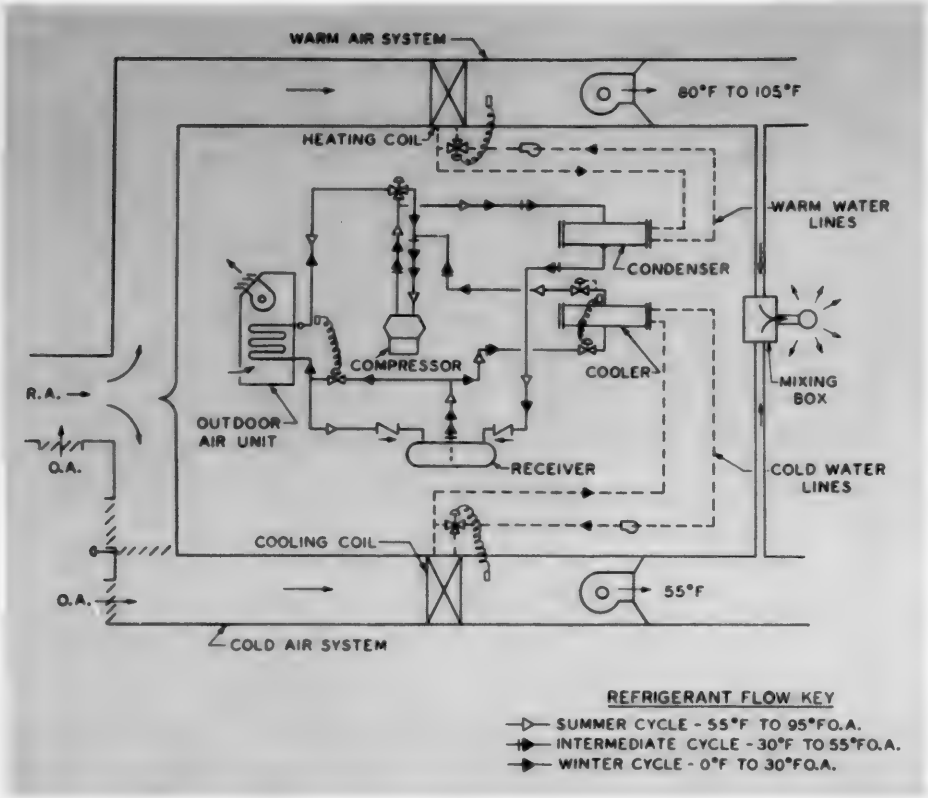


Fig. 9. Air source heat pump on dual duct air handling system.

ply air is introduced to the building at a central point near the compressor room. It becomes impractical to run long refrigerant lines to scattered coils located throughout the building because of the first cost, including insulation, the leak hazard with expensive refrigerants, increased maintenance, and design problems brought about by increased pressure drop in the refrigerant circuit. Also, it should be kept in mind that a system provided with liquid subcooling means, will only be beneficial when the normal supply of fresh air is furnished to the building. When the fresh air supply is shut down during the unoccupied periods, the single stage system must operate without benefit of the extra capacity. On the two-stage system, this disadvantage can be offset by locating an intercooler in parallel with the subcooling coil, and no reduction in system capacity will be experienced.

Defrosting Methods

Continuous operation of an air source heat pump with evaporator temperatures below 25 to 30 deg will generally cause frost accumulation on the outdoor air coils which must be periodically removed. Otherwise, the coil would become completely blocked with frost, permitting no air flow through it, and the heat pump system would be ineffective. Fortunately, the defrosting frequency is greater at higher outdoor temperatures, since warmed air has the ability to hold a greater quantity of moisture. Depending upon a number of variables, the frequency of defrost is most severe at outside temperatures between approximately 28 and 40 deg and when high relative humidities are experienced. At lower outside air temperatures, the ability of the air to hold moisture is limited and fewer defrosts are required. At higher temperatures, the refrigerant temperature in the evaporator will be above the point where frost will form on the coil, and water condensing on the coil surface is easily drained from the unit.

Fin spacing on the outdoor coil is important in determining the frequency of defrost. Heat pump systems have been installed with fin spacing anywhere from 2 to as high as 14 fins per inch. With close spacing, little frost can build up on the coil surface without blocking air flow and frequent defrost cycles are required. Numerous defrost cycles means the unit will be available less time for heating, and these many cycles will increase the operating cost slightly.

Test results seem to indicate that the frequency of defrost is nearly proportional to the fin spacing, wherein a coil with three fins per inch might operate approximately four times as long between defrost cycles as would one containing twelve fins per inch. For this reason, it is recommended that industrial air source heat pump systems be designed with not more than four fins per inch. On the smaller residential packages, the wide spacing becomes impractical because of the large amount of coil surface required for air cooled condenser duty during the cooling season.

Some units with the closer spacing require a defrost after every 90 minutes of operating time. By contrast, an installation in New York with only 2.67 fins per inch on the outdoor coil went over four days without requiring a single defrost when the outside air temperature was in the range of about 20 to 35 deg.

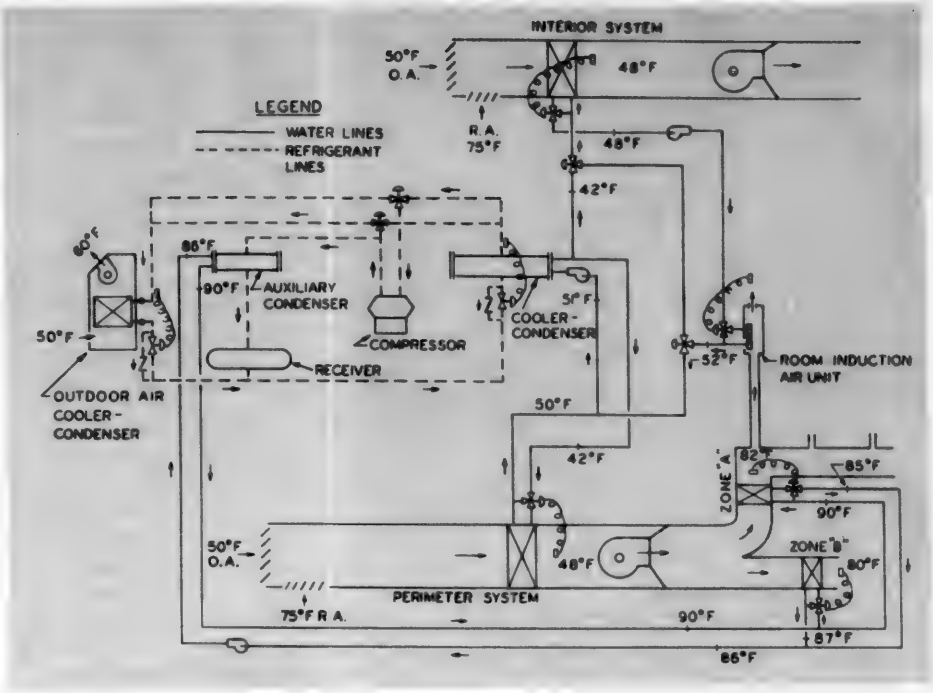


Fig. 10. Flow diagram of air source heat pump on high pressure air system. Outside air between 40 and 65 deg.

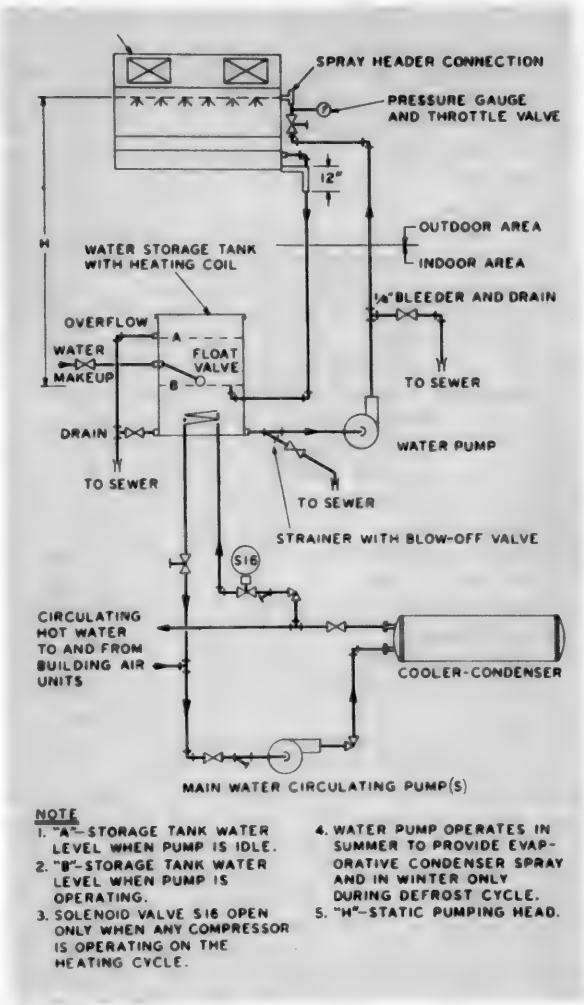

SPRAY HEADER CONNECTION
PRESSURE GAUGE AND THROTTLE VALVE
12"
H
OUTDOOR AREA
INDOOR AREA
WATER STORAGE TANK WITH HEATING COIL
¼" BLEEDER AND DRAIN
OVERFLOW
A
WATER MAKEUP
FLOAT VALVE
B
TO SEWER
DRAIN
WATER PUMP
TO SEWER
TO SEWER
STRAINER WITH BLOW-OFF VALVE
S16
CIRCULATING HOT WATER TO AND FROM BUILDING AIR UNITS
COOLER-CONDENSER
MAIN WATER CIRCULATING PUMP(S)
NOTE
1. "A"-STORAGE TANK WATER LEVEL WHEN PUMP IS IDLE.
2. "B"-STORAGE TANK WATER LEVEL WHEN PUMP IS OPERATING.
3. SOLENOID VALVE S16 OPEN ONLY WHEN ANY COMPRESSOR IS OPERATING ON THE HEATING CYCLE.
4. WATER PUMP OPERATES IN SUMMER TO PROVIDE EVAPORATIVE CONDENSER SPRAY AND IN WINTER ONLY DURING DEFROST CYCLE.
5. "H"-STATIC PUMPING HEAD.

Fig. 11. Hot water defrost method.

There are four commonly used methods of defrosting. They are:

1. Reverse refrigerant cycle (supplementary electric heaters).
2. Direct electric heating.
3. Hot water.
4. Thermal cycle.

Description of Defrosting Systems

Other defrosting methods have also been employed, but are less common and will not be mentioned here. With the first method listed, the outdoor coil is defrosted by reversing the refrigerant cycle so the system is, in essence, providing refrigeration to the building. Supplementary electric heaters located in the air stream or water circuit are energized to provide a source of heat without chilling the buildings. Where two or more independent heat pump systems are connected to a common water system, it may not be necessary to energize the supplementary heaters. When the electric supplementary heaters are used, this is the least efficient method, since each Btu used for defrosting, must be purchased directly from the electric utility. In addition, there are some losses at the compressor, resulting in less heat available than actually purchased in the form of electrical energy. On multiple systems where the supplementary heat may not be required, operation of the compressor adds to the electrical consumption.

In the second method, electric resistance heating probes are inserted in the outdoor coil in spaces provided between the refrigerant tubes. To defrost the coil, the compressor may be shut down and the coil is heated directly with electricity to melt the frost. This provides a slight improvement over the first method since the compressor is idle and no compressor and motor losses are encountered.

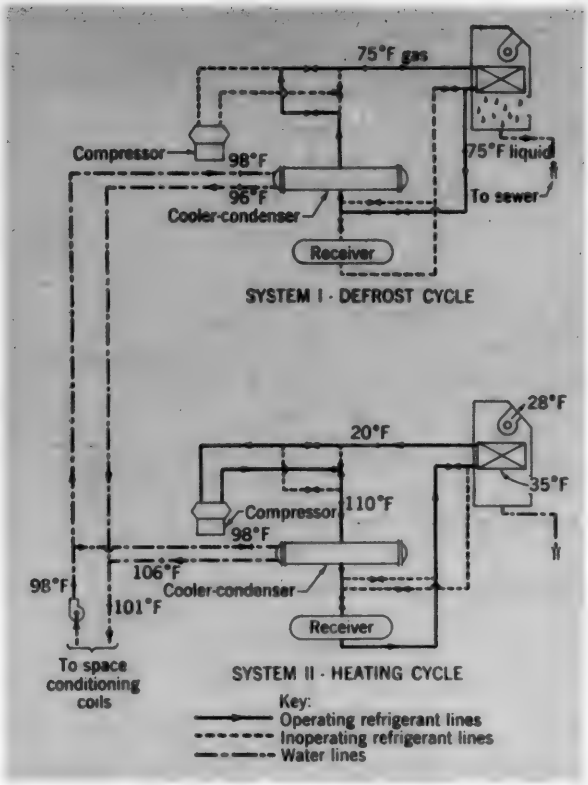


Fig. 12. York thermal cycle defrost.

The third method is illustrated in Fig. 11. A water tank is provided with a small water-to-water heating coil to heat the reservoir of water during the normal operating cycle. A small quantity of water from the main circulating system is by-passed around the space conditioning coils and introduced to the water tank heat exchanger to provide the necessary heat. When defrosting is required, the compressors are shut down and the warm water is sprayed over the coil surface to remove frost. The chilled water is returned to the tank where it will again be heated when the system returns to operation on the heating cycle. This arrangement provides very good operating economy since the heat stored in the tank is obtained on the heat pump principle, wherein approximately 3 Btu are made available for each Btu purchased from the electric utility. A similar method is to substitute a refrigerant liquid subcooling coil in lieu of the water-to-water heat exchanger.

The fourth method, Fig. 12, is also an efficient and practical method of defrosting the outdoor coils. It is known as the thermal cycle. This arrangement is limited to applications where two or more independent heat pump systems are located on a common water circuit, a rather common arrangement on larger commercial and industrial buildings. When one of two or more systems requires defrosting, its respective compressors are shut down and the automatic refrigerant positioning valves are reversed to permit thermal circulation of refrigerant between the indoor and outdoor heat exchangers. The other system or systems will remain in operation to provide the necessary heat to the parallel water circuit to remove frost from the idle system. The outdoor air unit is generally at an elevation above the indoor heat exchanger and by connecting the two with separate liquid and gas circuits, refrigerant can boil off in the indoor heat exchanger (winter condenser) and condense in the cold outdoor coil to melt the frost. The condensed liquid drains by gravity to the indoor heat exchanger and the circulation continues until the coil is clean. At the termination of the defrost cycle, the gas equalizing circuit is closed, permitting a buildup in gas pressure within the indoor heat exchanger. The higher pressure forces liquid back to the outdoor heat exchanger at the higher elevation so the system can again go into operation with a fully charged evaporator. Since the operating system(s) is providing heat for defrosting another system plus heating the building, the heat utilized for melting frost is again gained on the heat pump principle (3 Btu for 1), making it also extremely efficient.

Controls

Controls on heat pump systems today have advanced to the point where few conventional heating and cooling systems can match their performance, flexibility and automation. Factory assembled, pre-engineered, and custom built systems are available that are completely automatic for year-round operation with no switching or attention required by operators or maintenance personnel, other than the periodic inspections required for any other mechanical equipment. Outdoor and indoor thermostats tell the system when to heat, when to cool (sometimes simultaneously), and exactly how much capacity is required. The control even turns the system off when intermediate outdoor air temperatures are encountered to permit increased quantities of ventilation air to provide any cooling required in the building. Systems are automatically defrosted when necessary, and the heating water temperature may be automatically compensated to provide the optimum temperature level for good economy and best room temperature control.

Few conventional boiler-fired systems with non-reversible mechanical refrigeration can easily convert from heating to cooling without the services of personnel to make manual changes. This is particularly a problem where the same water circuit is used for both summer cooling and winter heating, wherein warm water from the heating system cannot be directly introduced to a water chiller due to the hazard of blowing the refrigerant charge through the relief device. Many other conventional systems have separate heating and chilled water circuits, but the sad result is that frequently, heat is poured into the building through the heating system while the mechanical cooling system is removing it, particularly during intermediate seasons.

Also, most conventional mechanical cooling systems on larger buildings require that the cooling tower or evaporative condenser be manually drained to prevent freeze-up during cold periods and again be refilled when warm weather is encountered. Electrical recording data from heat pump installations in even the northern climates indicate that mechanical cooling is occasionally required in October, November, December, and March, and even occasionally in January and February. Where manual changeover is required, building occupants usually suffer in overly heated spaces since the mechanical cooling system is generally winterized.

The heat pump system operates independently of the month of the year and knows only that building wants

heat, economizer cooling, mechanical cooling, or both heating and cooling. During the intermediate seasons, the heat pump will frequently provide heat throughout the night and early morning hours, go into the cooling cycle during the sunlit hours of the day, and return again to the heating cycle at night. Only a matter of minutes is required to reverse the cycle.

Nighttime thermostat setback in the conditioned spaces should be discouraged on heat pump installations. Several studies made for conventional heating systems indicate that nighttime setback cannot be justified on industrial and commercial buildings. When the space temperature is maintained at a lower temperature during the night on heat pump installations, the system is required to come into operation at full capacity when the building is again occupied and the thermostat set to a higher level. This results in higher electric demands on the power supply, penalizing the electric bill if a demand charge is involved, and furthermore, causes the system to operate less efficiently than for normal operation where the building load is in balance with the system capacity. Also, the heat pump should theoretically be oversized to allow for heat pickup in the morning hours.

Results from recorded data in a commercial establishment indicate that with nighttime setback, the morning temperature of the space only dropped but a few degrees, seldom reaching the setback temperature. However, due to the large mass of the building and inherent flywheel effect, approximately 2½ hours were required to soak the building objects and structure to the point where the heat system could reduce capacity to a value where it would be in balance with the heat loss. The air temperature itself picked up rapidly, so there was no actual loss in human comfort. As soon as the use of nighttime setback was abandoned, electrical billings on this installation were reduced.

TABLE 1.—COMPARISON OF ESTIMATED AND ACTUAL POWER CONSUMPTION, AS ADJUSTED

Heating Months	Estimated Consumption, Kwh		Actual kwh Consumption
	Average Weather Conditions	Pro-rated to Actual Weather Conditions	
November, 1956	50,694	45,172	38,592
December, 1956	51,406	44,464	44,064
January, 1957	59,414	57,667	59,616
February, 1957	48,720	45,308	48,096
March, 1957	32,800	33,651	24,480
Totals	243,034	226,262	214,848

Applications

Except in rare instances, an air source heat pump can only be justified in buildings requiring both summer cooling and winter heating. Consequently, a building requiring only winter heating is a poor prospect for a heat pump system. By the same token, for a building requiring year-round conditioning except for certain major areas, as garages and warehouses, it may be difficult to justify the heat pump due to the oversizing of equipment required for the design winter load.

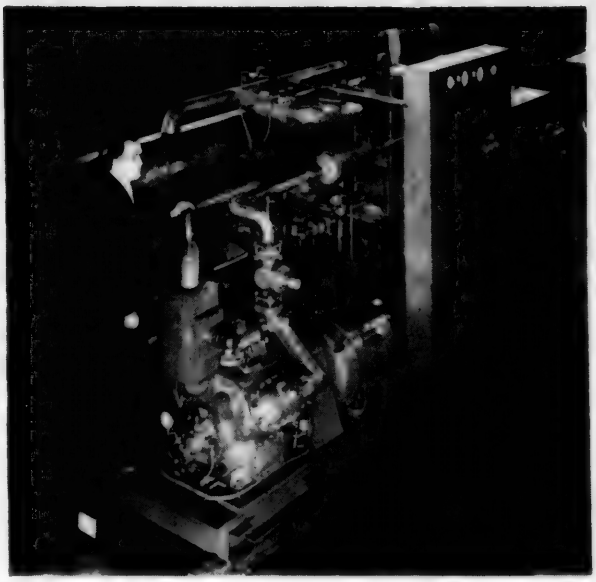


Fig. 13. The author in front of a factory assembled unit for the Morgan County Hospital.

In some buildings, the spaces not requiring cooling will represent a small portion of the total load, making the heat pump more attractive. Also, where the electric rate is favorable, direct resistance heaters may be incorporated at a low first cost to heat such areas, while the heat pump system handles other portions of the building that will be conditioned throughout the year.

In some buildings, the small heat pump packages in sizes from 3 to 10 tons capacity may be incorporated in conjunction with a central heat pump system. These may be advantageous in remote areas of the building to reduce installed costs of water piping and insulation, and to overcome possible freezeup hazards. Another consideration is the period of occupancy. Certain spaces may be occupied 24 hours a day, or at different hours than the remainder of the building, permitting the small package to handle these space while the central system may be shut down during unoccupied periods of the cooling season.

In the past, heat pumps of large refrigeration tonnage were field assembled. The writer's company is now producing heat pumps in capacities from 50 to 150 tons, completely assembled at the factory. A unit of 54 tons nominal capacity, Fig. 13, the first of the large units of this series, was installed in the 26-bed Morgan County Hospital, Madison, Ga.

Estimating Operating Costs

Estimating heat pump system operating costs differs widely from the method used for conventional gas, oil, or coal-fired heating systems. With the latter, the efficiency of a boiler will be essentially constant regardless of the outside air temperature, assuming continuous operation. In actual practice, the efficiency is reduced during mild weather due to the cyclic operation of the boiler and an average efficiency can be assumed, allowing for scale buildup, imperfect air-to-fuel ratios, cyclic operation, etc.

The air source heat pump system efficiency varies greatly with outside air temperature, higher temperatures

TABLE 2.—HEATING COST COMPARISON BETWEEN GAS, OIL AND HEAT PUMP SOURCES OF HEAT

Month	Comparison of Heating Costs*				Normal Deg. Days
	Estimated		Heat Pump		
	Gas	Oil	Estimated	Actual**	
January	$ 438	$ 449	$ 395	$ 416	933
February	358	365	352	324	837
March	337	342	284	211	667
April	211	210	158	147	369
May	50	48	40	27	93
June-Sept. ..	Cooling Only				33
October	143	129	94	54	219
November ..	268	271	221	212	516
December ..	360	379	361	343	856
Totals	$2165	$2193	$1905	$1734	4523

* Includes operation of all electric auxiliaries used for heating.
** Actual heat pump operating costs pro-rated to normal degree days of 4523 for comparison.

providing more efficient operation. Since the variation is large, it is necessary to take into consideration average weather data for the area in question when making the yearly analysis. Weather data are available for most cities throughout this country, and by means of system performance data at any outside air temperature and load condition, a fairly accurate analysis can be made.

Table 1 compares estimated versus actual electrical consumption for the Heironomus Department Store in Roanoke, Va. This four-story plus a mezzanine and basement store has approximately 90,000 square feet total floor area and was designed to operate effectively with a compound air source heat pump at outdoor temperatures as low as 0 deg. The system was designed to provide 312 tons refrigeration for summer cooling and 2,450,000 Btu per hr heating capacity.

Since the estimate was based on average weather conditions, it became necessary to pro-rate this calculation to the actual weather conditions experienced in the winter of 1956-57, as shown in the second column. The actual consumption compared quite favorably with the estimated. The fact that actual consumption was slightly lower than estimated was attributed to some sun effect, which is difficult to correct for in any analysis. The calculation took into consideration miscellaneous heat gains from within the building during the heating season. This installation was metered by the Appalachian Power Company of Roanoke, Va.

Another compound compression air source heat pump is the Ballinger Company Office Building in Philadelphia, Pa. This is a two-story contemporary design structure with approximately 16,000 square feet of floor area with heat absorbent glass walls extending from the ceiling of the first floor to the top edge of the roof. Check metering instruments were installed and operating data gathered by the Philadelphia Electric Company to obtain the comparison of the actual operating costs against those predicted. Table 2 shows the estimated operating costs for gas, oil, and the heat pump as compared to the actual. Again it became necessary to correct the electrical consumption to obtain a true comparison for the same weather data. The comparison indicates that the heat pump operation was again slightly better than predicted.

Half-A-Century Ago

The object of this paper* is to give data and results of the regular operation of a ventilating, heating and cooling plant installed in a bank building in New York City for the firm of Kuhn, Loeb & Co. In view of the relative scarcity of information of this character and the growing in favor of artificially cooling air supplied for ventilation purposes, it is hoped the figures will prove of value. The plant is now in its third year, and some interesting facts have been learned with regard to the best manner of introducing the cool air in summer, to the use of steam heating coils for the refrigerated medium, which, to the best knowledge of the writer, is the first time that it has ever been attempted, to the amelioration of drafts from windows, and finally to the use of the exhaust air from the banking rooms in cooling the engine-room.

The points to be considered are involved in the part of the plant serving the banking offices of Kuhn, Loeb & Co., comprising about 85,000 cu. ft., in the ground floor of that company's 20-story building on William and Pine Streets. The building is of L shape, giving light in the rear, with the ground floor extending over the entire lot, with a skylight over the extension. Mechanical ventilation, to insure a constant supply of fresh air with a coincident removal of the vitiated air, is provided for the banking offices only. The building has its own isolated power plant, which is located in the basement. Two-thirds of the ground floor is thus directly over the boiler and engine-rooms (there is no sub-basement in this building).

In the original lay-out, the ducts for carrying the fresh air supply to, as well as the exhaust air from the banking rooms were under the ceiling of the engine and boiler-rooms, with a result that the fresh air was always overheated and odorous from the engine-room, etc., through conditions peculiar to the building. Considerable heat was also transmitted into the offices through the floor, notwithstanding that the latter was insulated underneath with a suspended ceiling of magnesia blocks.

The writer was called upon to devise a scheme for the introduction of a supply of fresh air without going through the engine- and boiler-rooms in the basement, also for cooling the banking rooms, to counteract the heat from the floor and make the occupants comfortable. After a careful study of the situation, the writer designed a combination ventilating, heating and cooling plant, which was installed under his supervision, and which has given very satisfactory results for the past three years. . . . *From The Heating and Ventilating Magazine, Vol. 6—August, 1909.*

* By A. M. Feldman, read before The American Society of Heating and Ventilating Engineers at Indianapolis, July 16, 1909.

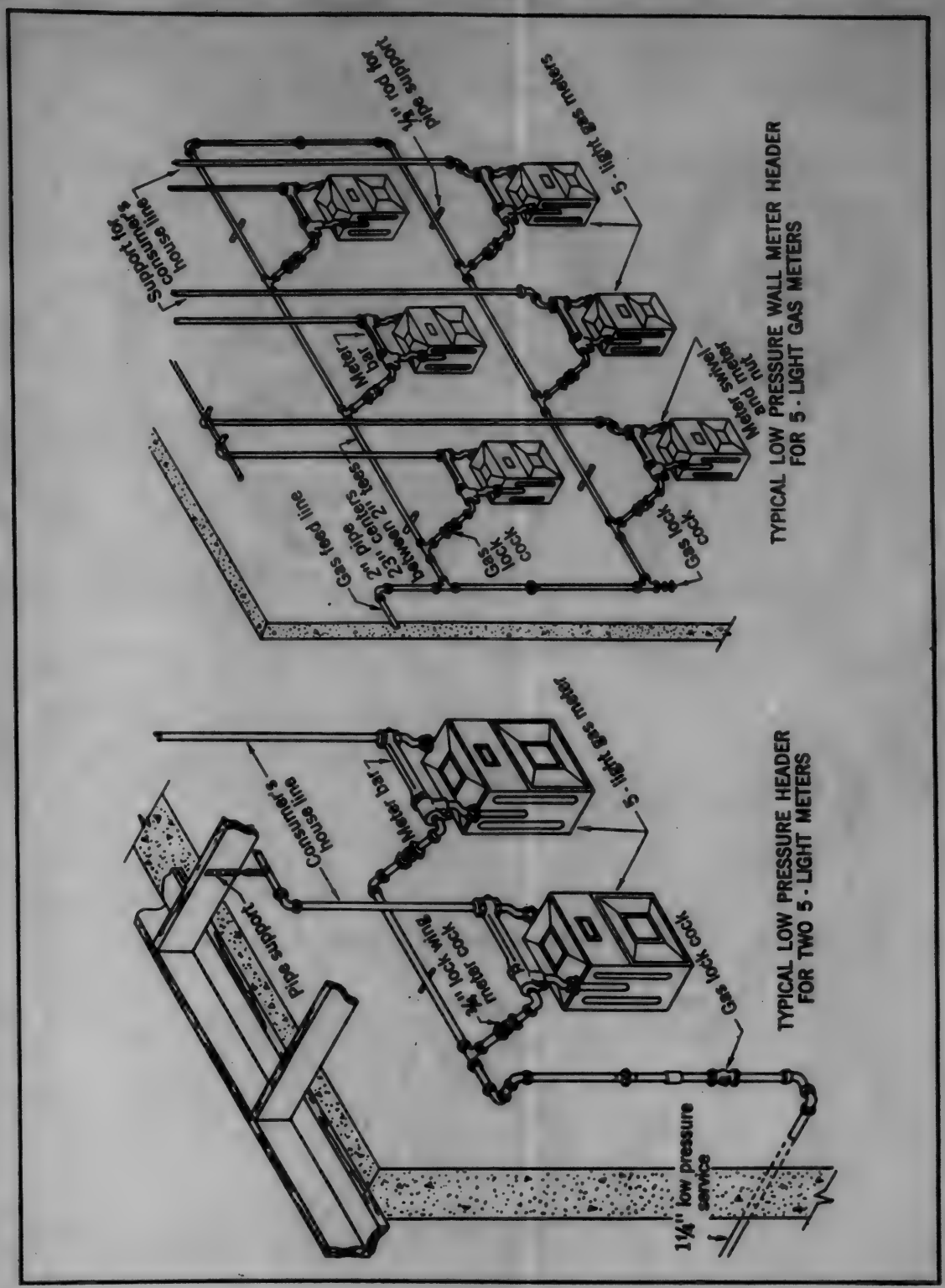
THE DISCOMFORT INDEX *(Concluded)*

Dry Bulb Temperature, Deg F	Relative Humidity, Per Cent															
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Discomfort Index															
70	64.1	64.1	64.2	64.3	64.3	64.4	64.5	64.5	64.6	64.7	64.7	64.8	64.9	64.9	65.0	65.1
71	64.6	64.6	64.7	64.8	64.9	64.9	65.0	65.1	65.1	65.2	65.3	65.4	65.4	65.5	65.6	65.6
72	65.1	65.1	65.2	65.3	65.4	65.5	65.5	65.6	65.7	65.8	65.8	65.9	66.0	66.1	66.1	66.2
73	65.6	65.7	65.7	65.8	65.9	66.0	66.1	66.2	66.2	66.3	66.4	66.5	66.6	66.6	66.7	66.8
74	66.1	66.3	66.3	66.3	66.4	66.5	66.6	66.7	66.8	66.9	67.0	67.0	67.1	67.2	67.3	67.4
75	66.6	66.7	66.8	66.9	67.0	67.1	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0
76	67.1	67.2	67.3	67.4	67.5	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6
77	67.6	67.7	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.6	68.7	68.8	69.0	69.1	69.2
78	68.1	68.2	68.3	68.4	68.5	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.8
79	68.6	68.7	68.8	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.8	69.9	70.0	70.1	70.2	70.3
80	69.1	69.2	69.4	69.5	69.6	69.7	69.8	70.0	70.1	70.2	70.3	70.4	70.6	70.7	70.8	70.9
81	69.6	69.7	69.9	70.0	70.1	70.2	70.4	70.5	70.6	70.8	70.9	71.0	71.1	71.3	71.4	71.5
82	70.1	70.3	70.4	70.5	70.6	70.8	70.9	71.0	71.2	71.3	71.4	71.6	71.7	71.8	72.0	72.1
83	70.6	70.8	70.9	71.0	71.2	71.3	71.5	71.6	71.7	71.9	72.0	72.1	72.3	72.4	72.6	72.7
84	71.1	71.3	71.4	71.6	71.7	71.8	72.0	72.1	72.3	72.4	72.6	72.7	72.8	73.0	73.1	73.3
85	71.6	71.8	71.9	72.1	72.2	72.4	72.5	72.7	72.8	73.0	73.1	73.3	73.4	73.6	73.7	73.9
86	72.1	72.3	72.4	72.6	72.8	72.9	73.1	73.2	73.4	73.5	73.7	73.8	74.0	74.1	74.3	74.5
87	72.5	72.8	73.0	73.1	73.3	73.4	73.6	73.8	73.9	74.1	74.2	74.4	74.6	74.7	74.9	75.0
88	73.2	73.3	73.5	73.6	73.8	74.0	74.1	74.3	74.5	74.6	74.8	75.0	75.1	75.3	75.5	75.6
89	73.7	73.8	74.0	74.2	74.3	74.5	74.7	74.8	75.0	75.2	75.4	75.5	75.7	75.9	76.0	76.2
90	74.2	74.3	74.5	74.7	74.9	75.0	75.2	75.4	75.6	75.7	75.9	76.1	76.3	76.4	76.6	76.8
91	74.7	74.8	75.0	75.2	75.4	75.6	75.8	75.9	76.1	76.3	76.5	76.7	76.8	77.0	77.2	77.4
92	75.2	75.4	75.5	75.7	75.9	76.1	76.3	76.5	76.7	76.9	77.0	77.2	77.4	77.6	77.8	78.0
93	75.7	75.9	76.1	76.3	76.4	76.7	76.8	77.0	77.2	77.4	77.6	77.8	78.0	78.2	78.4	78.6
94	76.2	76.4	76.6	76.8	77.0	77.2	77.4	77.6	77.8	78.0	78.2	78.4	78.6	78.8	79.0	79.2
95	76.7	76.9	77.1	77.3	77.5	77.7	77.9	78.1	78.3	78.5	78.7	78.9	79.1	79.3	79.5	79.7
96	77.2	77.4	77.6	77.8	78.0	78.2	78.4	78.7	78.9	79.1	79.3	79.5	79.7	79.9	80.1	80.3
97	77.7	77.9	78.1	78.3	78.6	78.8	79.0	79.2	79.4	79.6	79.8	80.1	80.3	80.5	80.7	80.9
98	78.2	78.4	78.6	78.9	79.1	79.3	79.5	79.7	80.0	80.2	80.4	80.6	80.8	81.1	81.3	81.5
99	78.7	78.9	79.2	79.4	79.6	79.8	80.1	80.3	80.5	80.7	81.0	81.2	81.4	81.6	81.9	82.1
100	79.2	79.4	79.7	79.9	80.1	80.4	80.6	80.8	81.1	81.3	81.5	81.8	82.0	82.2	82.4	82.7
102	80.2	80.5	80.7	80.9	81.2	81.4	81.7	81.9	82.2	82.4	82.6	82.9	83.1	83.4	83.6	83.9
104	81.2	81.5	81.7	82.0	82.2	82.5	82.7	83.0	83.3	83.5	83.8	84.0	84.3	84.5	84.8	85.0
106	82.2	82.5	82.8	83.0	83.3	83.6	83.8	84.1	84.4	84.6	84.9	85.1	85.4	85.7	85.9	86.2
108	83.3	83.5	83.8	84.1	84.4	84.6	84.9	85.2	85.5	85.7	86.0	86.3	86.6	86.8	87.1	87.4
110	84.3	84.5	84.8	85.1	85.4	85.7	86.0	86.3	86.5	86.8	87.1	87.4	87.7	88.0	88.3	88.6
112	85.3	85.6	85.9	86.2	86.5	86.8	87.1	87.3	87.6	87.9	88.2	88.5	88.8	89.1	89.4	89.7
114	86.3	86.6	86.9	87.2	87.5	87.8	88.1	88.4	88.7	89.1	89.4	89.7	90.0	90.3	90.6	90.9
116	87.3	87.6	87.9	88.2	88.6	88.9	89.2	89.5	89.8	90.2	90.5	90.8	91.1	91.4	91.8	92.1
118	88.3	88.6	89.0	89.3	89.6	90.0	90.3	90.6	90.9	91.3	91.6	91.9	92.3	92.6	92.9	93.3
120	89.3	89.7	90.0	90.3	90.7	91.0	91.4	91.7	92.0	92.4	92.7	93.1	93.4	93.7	94.1	94.4

THE DISCOMFORT INDEX

Dry Bulb Temperature, Deg F	Relative Humidity, Per Cent															
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
	Discomfort Index															
70	65.1	65.2	65.2	65.3	65.4	65.4	65.5	65.6	65.6	65.7	65.8	65.8	65.9	66.0	66.0	66.1
71	65.7	65.8	65.9	65.9	66.0	66.1	66.1	66.2	66.3	66.4	66.4	66.5	66.6	66.6	66.7	66.8
72	66.3	66.4	66.5	66.5	66.6	66.7	66.8	66.8	66.9	67.0	67.1	67.1	67.2	67.3	67.4	67.5
73	66.9	67.0	67.1	67.1	67.2	67.3	67.4	67.5	67.6	67.6	67.7	67.8	67.9	68.0	68.1	68.1
74	67.5	67.6	67.7	67.8	67.8	67.9	68.0	68.1	68.2	68.3	68.4	68.5	68.5	68.6	68.7	68.8
75	68.1	68.2	68.3	68.4	68.5	68.5	68.6	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5
76	68.7	68.8	68.9	69.0	69.1	69.2	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2
77	69.3	69.4	69.5	69.6	69.7	69.8	69.9	70.0	70.1	70.2	70.3	70.4	70.5	70.6	70.7	70.8
78	69.9	70.0	70.1	70.3	70.3	70.4	70.5	70.6	70.7	70.9	71.0	71.1	71.2	71.3	71.4	71.5
79	70.5	70.6	70.7	70.8	70.9	71.0	71.1	71.3	71.4	71.5	71.6	71.8	71.8	72.0	72.1	72.2
80	71.0	71.2	71.3	71.4	71.5	71.7	71.8	71.9	72.0	72.1	72.3	72.4	72.5	72.6	72.7	72.9
81	71.6	71.8	71.9	72.0	73.1	72.3	72.4	72.5	72.7	72.8	72.9	73.0	73.2	73.3	73.4	73.5
82	72.2	72.4	72.5	72.6	72.8	72.9	73.0	73.2	73.3	73.4	73.6	73.7	73.8	73.9	74.1	74.2
83	72.8	73.0	73.1	73.2	73.4	73.5	73.7	73.8	73.9	74.1	74.2	74.3	74.5	74.6	74.8	74.9
84	73.4	73.6	73.7	73.8	74.0	74.1	74.3	74.4	74.6	74.7	74.8	75.0	75.1	75.3	75.4	75.6
85	74.0	74.2	74.3	74.4	74.6	74.8	74.9	75.1	75.2	75.3	75.5	75.5	75.8	75.9	76.1	76.2
86	74.6	74.8	74.9	75.1	75.2	75.4	75.5	75.7	75.8	76.0	76.1	76.3	76.5	76.6	76.8	76.9
87	75.2	75.4	75.5	75.7	75.8	76.0	76.2	76.3	76.5	76.6	76.8	77.0	77.1	77.3	77.4	77.6
88	75.8	76.0	76.1	76.3	76.5	76.6	76.8	76.9	77.1	77.3	77.4	77.6	77.8	77.9	78.1	78.3
89	76.4	76.5	76.7	76.9	77.1	77.2	77.4	77.6	77.7	77.9	78.1	78.3	78.4	78.6	78.8	78.9
90	77.0	77.2	77.3	77.5	77.7	77.9	78.0	78.2	78.4	78.6	78.7	78.9	79.1	79.3	79.4	79.6
91	77.6	77.8	77.9	78.1	78.3	78.5	78.7	78.8	79.0	79.2	79.4	79.6	79.7	79.9	80.1	80.3
92	78.2	78.3	78.5	78.7	78.9	79.1	79.3	79.5	79.7	79.8	80.0	80.2	80.4	80.6	80.8	81.0
93	78.8	78.9	79.1	79.3	79.5	79.7	79.9	80.1	80.3	80.5	80.7	80.9	81.1	81.3	81.5	81.6
94	79.3	79.5	79.7	79.9	80.1	80.3	80.5	80.7	80.9	81.1	81.3	81.5	81.8	81.9	82.1	82.3
95	79.9	80.1	80.3	80.6	80.8	81.0	81.2	81.4	81.6	81.8	82.0	82.1	82.4	82.6	82.8	83.0
96	80.5	80.7	81.0	81.2	81.4	81.6	81.8	82.0	82.2	82.4	82.6	82.8	83.0	83.3	83.5	83.7
97	81.1	81.3	81.6	81.8	82.0	82.2	82.4	82.6	82.8	83.1	83.3	83.5	83.7	83.9	84.1	84.3
98	81.7	81.9	82.2	82.4	82.6	82.8	83.0	83.3	83.5	83.7	83.9	84.1	84.4	84.6	84.8	85.0
99	82.3	82.5	82.8	83.0	83.2	83.4	83.7	83.9	84.1	84.3	84.6	84.8	85.0	85.2	85.5	85.7
100	82.9	83.1	83.4	83.6	83.8	84.1	84.3	84.5	84.8	85.0	85.2	85.4	85.7	85.9	86.1	86.4
102	84.1	84.3	84.6	84.8	85.1	85.3	85.5	85.8	86.0	86.3	86.5	86.8	87.0	87.2	87.5	87.7
104	85.3	85.5	85.8	86.0	86.3	86.5	86.8	87.0	87.3	87.6	87.8	88.1	88.2	88.6	88.8	89.1
106	86.5	86.7	87.0	87.3	87.5	87.8	88.0	88.3	88.6	88.8	89.1	89.4	89.6	89.9	90.2	90.4
108	87.7	87.9	88.2	88.5	88.8	89.0	89.3	89.6	89.9	90.1	90.4	90.7	91.0	91.3	91.5	91.8
110	88.8	89.1	89.4	89.7	90.0	90.3	90.6	90.8	91.1	91.4	91.7	92.0	92.3	92.6	92.8	93.1
112	90.9	90.3	90.6	90.9	91.2	91.5	91.8	92.1	92.4	92.7	93.0	93.3	93.6	93.9	94.2	94.5
114	91.2	91.5	91.8	92.1	92.4	92.7	93.1	93.4	93.7	94.0	94.3	94.6	94.9	95.2	95.5	95.8
116	92.4	92.7	93.0	93.4	93.7	94.0	94.3	94.6	94.9	95.3	95.6	95.9	96.2	96.5	96.9	97.2
118	93.6	93.9	94.2	94.6	94.9	95.2	95.6	95.9	96.2	96.6	96.9	97.2	97.5	97.9	98.2	98.5
120	94.8	95.1	95.4	95.8	96.1	96.5	96.8	97.2	97.5	97.8	98.2	98.5	98.9	99.2	99.5	99.9

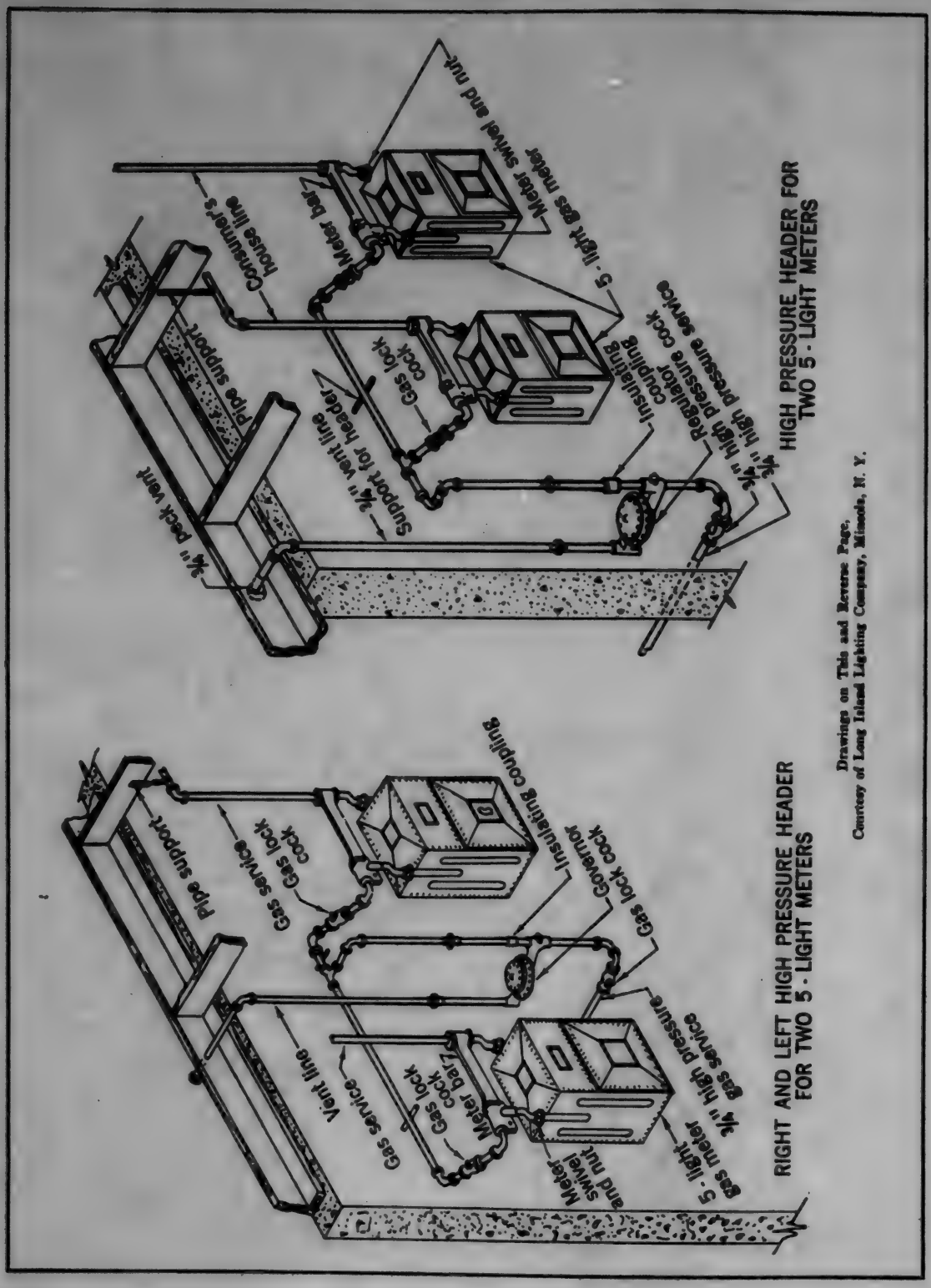
CONNECTIONS FOR GAS METERS



DETAIL SHEET--AIR CONDITIONING, HEATING AND VENTILATING

August, 1959

CONNECTIONS FOR GAS METERS



Drawings on This and Reverse Page,
Courtesy of Long Island Lighting Company, Mineola, N. Y.

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

August, 1959

Window Shading, Ventilation, Refrigerants

are among subjects at annual meeting of ASHRAE. Hess is new president, Cross new executive secretary

About eight hundred members and guests attended the annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., held at the Lake Placid Club, New York, June 22-24. The meeting was featured by the installation of new officers, technical sessions on refrigerating compressors, ventilation, noise, heat transfer, sound level, general refrigeration and air conditioning, and conferences or forums on domestic refrigeration, industrial ventilation and cryogenics.

Arthur J. Hess
Newly-installed president of ASHRAE

The new president is A. J. Hess, with D. D. Wile as first vice-president, W. A. Grant as second vice president, R. H. Tull as third vice president and John Everetts, Jr. as fourth vice president. F. Y. Carter is first treasurer and John H. Fox is second treasurer.

Cross Is New Secretary

Announcement was made on the last day of the meeting that the board of directors had appointed Robert C. Cross as executive secretary of the Society, effective July 1. Mr. Cross succeeds Aubry V. Hutchinson, who becomes executive secretary emeritus. The announcement was made by the new president, Mr. Hess, who said "Since the merger of its predecessor Societies ASHAE and ASRE last January, we have felt the need for a single administrative head to govern all staff activities at New York headquarters. Mr. Cross, as former executive secretary of the American Society of Refrigerating Engineers, brings to the combined organization an impressive record of professional achievement and experience in industry, as well as Society affairs.

"Mr. Hutchinson has served the other predecessor group, American Society of Heating and Air-Conditioning Engineers, as secretary and manager of publications with loyalty and devotion over a period of more than 37 years," Mr. Hess continued. "As executive secretary emeritus, he will, in a consulting capacity, bring to bear his long experience on the more challenging problems facing our newly-merged organization today."

Digests of some of the papers follow:

The Effect of Fuel Composition on Oil Burner Noise was discussed in a paper by William A. Beach, Richard W. Sage and Herbert F. Schroeder, all with the Process Division of Esso Engineering Company. Sound measurement revealed the flame to be the major noise source and despite wide variations in the fuel compositions used in the test the authors reported that there was no significant differences in the overall noise level among the different fuels and that the results were also independent of the type of burner used. The authors concluded that oil composition does not affect oil burner noise.

Application of evaporative storage for common fruits and vegetables was the subject of a paper by Robert S. Ash, Assistant to the President, International Metal Products Company, Phoenix, Arizona. With this type of cooling high humidity to prevent shrinkage and lower temperature to reduce respiration are achieved, with the additional benefit of fresh air to carry away ripening gases and to prevent odor.

Grille Noises

An experimental study of grille noise characteristics was reported on by B. H. Marvet, mechanical engineer, Division of Design, Tennessee Valley Authority. Among Mr. Marvet's conclusions were the following:

1. Grille face velocity, fin spacing, and static pressure loss are interrelated factors influencing the frequency characteristics and loudness rating of grille noise.

2. Octave-band sound-pressure level of grille noise is a function of the grille face velocity.

3. Increasing the grille face velocity results in a greater percentage of higher frequencies in the grille noise spectrum.

4. Grilles with a larger number of fins per inch tend to have higher-frequency predominance in the grille noise spectrum.

5. Grilles with higher pressure losses have greater magnitudes of sound-pressure levels in the high-frequency range of the grille noise spectrum.

6. Loudness rating of grille noise is dependent upon the high-frequency range of the grille noise spectrum.

7. Increasing the grille face velocity results in a rapidly increasing loudness rating of the grille noise.

8. Grilles with a large number of fins per in. or a large static pressure loss, will have a high loudness rating of grille noise.

C. M. Ashley, chief staff engineer, Carrier Corporation, presented a discussion of the proposed ASHRAE standards of sound level for equipment in connection with comfort air conditioning.

The question of estimating water content of certain dried but uncharged hermetic refrigerating compressors was the subject of a paper by Howard M. Elsey, chemical consultant; James B. Kelley and Richard B. Sharpe, process engineers, refrigerator-freezer engineering, Westinghouse Electric Corporation.

Refrigerants

A comparison of fluoroalkane refrigerants was the subject of a paper by B. J. Eiseman, Jr., Freon products laboratory, E. I. du Pont de Nemours & Co., Inc. The author concluded that the dimethyl ether of tetraethylene glycol (DME-TEG) is the preferred absorbent, and merits careful consideration on all absorption refrigeration applications.

O. W. Witzell, professor of Mechanical Engineering and C. Z. Kamien, instructor in Mechanical Engineering, both of Purdue University, presented a paper on the effect of pressure and temperature on the viscosity of refrigerants in the vapor phase and pre-

sented tables on experimental data of vapor viscosities of a variety of refrigerants at 1, 3, 6, 12 and 20 atmospheres. They concluded that the effect of pressure on viscosity of the families of refrigerant vapors is not great but suggested that more viscosity values are desired.

Window Shading

The effectiveness of window shading materials in reducing heat gain from solar radiation was investigated and reported on by Professor Richard C. Jordan, Head, and Professor James L. Threlkeld, Department of Mechanical Engineering, both of the University of Minnesota. The authors reported that the shade transmission factor E_s as determined by test was as follows:

Window shade of bleached cotton cloth, vinyl resin solution coating, and fireproofed, partially translucent, slightly glossy, buff-colored surfaces, 0.28.

Window shade of bleached cotton cloth, vinyl resin solution coating, partially translucent, white in color, low surface gloss, 0.23.

Window shade of bleached Kraft paper base, vinyl resin solution coating, partially translucent, embossed white surfaces on both side, 0.23.

Window shade of cloth base, treated and coated with vinyl resin, opaque, slightly glossy white finish on both sides of the material, 0.18.

Window shade of vinyl-coated cotton base, opaque, laminated with embossed aluminum foil on one side and white, coated surface on the other, 0.14.

A paper from the Research Laboratory of the Society on heat flow through glass with roller shades was presented by Necati Ozisik, research engineer, and L. F. Schutrum, research supervisor. In this study, summer heat gains and winter heat losses through a glass-roller-shade combination were investigated for shades of different materials and colors as well as for different type glasses and various glass-shade openings. Included were data related to heat gains for typical combinations in East, South and West orientations and for various hours of the day. In addition, the authors presented a table showing the reduction in heat gain made by fully drawn roller shades; this reduction ranged from 28 to 68%, depending on the type of shade and whether the wall was facing south or west.

Evaluation of three room air distribution systems for summer cooling was reported on by Reinmann, Koestel and Tuve. This report was a continuation of a paper presented by Professor Koestel and Professor Tuve in 1955. The three different systems embodied high side wall supply outlets, baseboard radial diffusers and round ceiling diffusers, respectively.

W. F. Hopper, research engineer at the ASHRAE Research Laboratory, presented a paper on surface odor adsorption and retention properties measured in which the author described a test method of measuring odor adsorption of cotton, wool, nylon and rayon.

Window Condensation

A. Grant Wilson and E. Nowak, both with the National Research Council of Canada, Division of Building Research, reported on condensation between panes of double windows. They analyzed the factors involved in the transfer of water vapor to and from the air space. They presented facts on the pressure distributions across the panes with respect to the relative air resistance of the cracks around inner and outer panes, and considered the role of buoyancy forces in transferring vapor by air flow. Vapor transfer by diffusion was compared with transfer by air flow for a specific window, and these results were in turn compared with observations of window condensation in cold room installation. Buoyancy forces were found to be the most effective means of condensation control. The authors also discussed the effect such venting has on heat transmission.

Another Canadian paper was that by K. R. Solvason, associate research officer, Division of Building Research, National Research Council, on large scale wall heat-flow measuring apparatus. This apparatus tests an 8 x 8 ft. wall section and is expected to provide correct and realistic means for obtaining steady-state heat flows or conductances through built-up wall sections, windows and doors.

Heat Gain through Glass

Solar radiation gains through directional glass exposure was the subject of a paper by R. D. Cramer, assistant professor of Housing, Department of Home Economics, and L. W. Neubauer, associate professor of Agricultural Engineering, both of the University of California. Results were reported from tests conducted with an 8-ft. cubicle having one side constructed of glass. The cubicle was oriented in various directions with reference to the sun, and the solar radiant gains caused changes in the air temperature in the cubicle. The tests were conducted in Davis, Calif., where high daytime dry-bulb temperatures prevail throughout July and August, with cooler night temperatures, and where there is little if any summer rain. The cubicle was kept tightly sealed and there was little or no infiltration of air or ventilation. Tests were conducted with unobstructed glass as well as with various screening devices located inside the glass such as blinds, drapes and screens and with various shading devices located outside the glass. Tests were also carried out when the cubicle was completely shaded from direct sun radiation. Changes in the curves of inside temperature gave a comparative means of judging effect of each device tested, and an indication of effect of complete shade.

It was broadly generalized that inside screening devices which hang flat against the glass and which have smooth surfaces are better barriers against radiation than those which hang away from the glass. Also the results appear to bear out the importance of intercepting solar radiation before it enters a structure rather than afterwards.

An industrial ventilation conference of which G. B. Priester, air-conditioning engineer, Baltimore Gas & Electric Company, was chairman, included four excellent papers as follows:

Design and Performance of Industrial Supply Air Systems—J. H. Clarke, Visking Corp., Div. of Union Carbide Corp., Chicago, Ill.

Dust and Fume Control Systems—P. J. Marschall, Chief Mechanical Engineer, Abbott Laboratories, North Chicago, Ill.

General Ventilation in the Steel Industry—F. E. Tucker, Industrial Hygienist, Weirton Steel Co., Weirton, W. Va.

Radiant Heat Control in Industrial Plants—W. G. Hazard, Industrial Relations Div., Owens-Illinois Glass Co., Toledo, Ohio.

A. V. Hutchinson
". . . served the ASHAE with loyalty and devotion over a period of more than 37 years"

Robert C. Cross
". . . brings to [ASHRAE] an impressive record of professional achievement . . ."

A fundamental analysis of chimney performance accompanied by a separate paper on a method of chimney design and performance evaluation based on the previous paper was presented by W. C. Moffatt, lecturer, Department of Mechanical Engineering, Royal Military College of Canada and W. G. Colborne, associate professor, Department of Engineering, Assumption University of Windsor, Ontario.

A method of using an automatic computer for fan testing was described by C. H. Pountney, Jr., director of research and D. W. Skipworth, senior research engineer, Viking Air Products Div., National-U. S. Radiator Corporation.

N. A. Richardson, assistant director, Industrial Cooperation, Department of Engineering and W. C. Middleton, Associated Research Psychologist, Department of Engineering, both of the University of California, reported on tests made to evaluate filters for removing irritants from polluted air. The tests were made with activated carbon filters and a particulate filter. Effectiveness of the former in removing oxidants was directly related to the detention time.

A method of showing the advantages of steam turbine-driven centrifugal refrigeration systems as compared to steam operated absorption refrigeration systems was presented by W. G. Dorsey, Jr., zone manager, Air Conditioning and Refrigeration Div., Worthington Corporation.

In answer to a question posed by the American Gas Association, "How can the potential energy in natural gas be transformed into a refrigerating effect with high efficiency and low first equipment cost in such a way as to be attractive for residential air conditioning service?", a Battelle Institute research group developed a free-piston compressor. The approach was to combine the spark-ignition gas engine, and the vapor-compression refrigeration cycle in such a way that the initial installment, maintenance costs, and the noise level would not be deterrents to its general acceptance. The compressor is designed for efficiency, and low cost production, but it does not yet have a manufacturer. The research group consisted of R. J. McCrory, Chief, R. W. King, Assistant Chief and J. H. McNinch, Project Leader in the Mechanical Research Division of Battelle Memorial Institute.

The effects of refrigerant properties on centrifugal compressor impeller dimensions and stage performance were reported on by F. J. Wiesner, Jr., senior engineer and H. E. Caswell, manager, both of the Centrifugal Refrigeration Engineering Dept., Carrier Corporation.

The closing conference at the convention was one on cryogenics with particular reference to closed circuit transportation of cryogenic fluids. V. J. Johnson of the Cryogenics Engineering Laboratory, National Bureau of Standards, Denver, Colorado, was the chairman.

Controlled-Climate Facilities for Biologists

A need for controlled-climate facilities for biologists was interestingly presented in an article in the September 5, 1958, issue of *Science*. Authors S. B. Hendricks and F. W. Went were members of a committee financed by the National Science Foundation to study the feasibility of "biotrons", including not only botanical but also zoological needs. Controlled environmental studies on plant life were being carried on at that time in a facility, dubbed a "phytotron", at the Earhart Laboratory at California Institute of Technology. Interest in such facilities had also been expressed by others experimenting with animals; thus the concept of a "biotron" developed.

The need was evidently seen to be a sound one, because, according to *The New York Times*, the National Science Foundation has announced plans to construct a controlled-environment laboratory to study the effects of environment on plants and animals.

The laboratory will be constructed at the University of Wisconsin with the assistance of a $1,500,000 grant from the foundation. The grant is the largest yet made by the foundation's Division of Biology and Medical Sciences.

The laboratory will give botanists and zoologists a powerful new tool for exploring the influence of environment in regulating biological rhythms, such as the migratory habits of birds, the reproductive cycle of animals and the diurnal cycle followed by many animals and plants.

There is increasing scientific evidence that environmental factors, such as light and temperature, play a profound role in influencing these biological rhythms. Scientific research in this field has been limited, however, by the difficulties in controlling the many and variable environmental conditions in laboratory experiments.

A spokesman, Dr. Waterman, said that "to the best of our knowledge, the Wisconsin facility will be the only one of its kind in the world." His statement was conditioned because of unconfirmed reports that the Soviet Union might be building or has built such a laboratory.

The Wisconsin facility will provide biologists with the nation's first controlled-environment laboratory for the study of animal development and the second such facility for studying plant growth.

Dr. Waterman said that a wide range of physiological, ecological, pathological, behavioral, climatological and other types of research would be carried out at the Wisconsin facility. The combination of plant and animals studies in one facility, he said, will enable botanists and zoologists to consider common scientific problems and their interaction.

The animal part of the laboratory will contain several environment rooms with precise control of temperature, humidity, light, noise and air velocity, as well as atmospheric composition and pressure. Special partitions are planned to permit remote observation of the animals by closed-circuit television.

Experiments on a variety of animals, ranging from small insects to mammals as large as rats and hamsters, will be carried out in the laboratory.

The plant section of the facility will have thirty artificially lit environmental growth rooms as well as conventional and controlled-temperature greenhouses. Rooms for dew, rain, high air velocity and low temperature coupled with high light intensity also will be included in the lab.

It is expected that the laboratory will become a national center for biological research and not be restricted to use of University of Wisconsin scientists.

How Cooling Load Varies With North Wall Orientation

When a building's north wall inclines to the East or West, one can predict how the solar cooling load in each of the building's zones will change. The author discusses these changes as they affect design of all-air and of perimeter induction air conditioning systems. At left, north and west walls of Dun & Bradstreet building, New York City.

S. DARYANANI
Design Engineer, Syska & Hennessy, Inc., New York, N. Y.

IT is very rare that the North line of a building will coincide with actual geographical North. The difference, though small, can have a very important bearing on design of an air conditioning system for the building.

Though a small declination may not materially affect the instantaneous peak load, it may be necessary to check the difference, especially in the case of air conditioning systems requiring large amounts of fresh air. Because of the declination the maximum instantaneous load may shift, say, from August to September. The fresh air load in September being less than that of August, a small cooling plant might suffice.

The major effect of declination will be found to be on air requirements of various zones. The effect on an all-air system is slightly different than on a system using perimeter cooling with induction units.

Effect on All-Air System

North Zone—Minimum cooling, and therefore a minimum quantity of conditioned air, is required for the north zone of a building only when the building's north line coincides with the actual north line. A small declination to the east or west will increase air requirements considerably. Declination towards the east is more serious, as maximum load will occur early in the morning and therefore this zone must be designed without taking advantage of any storage effect, since no precooling will be available if the air conditioning system is used only for ten hours a day. Declination towards the west will need slightly less cooling air because there will be a storage effect.

Table I (right) shows maximum values of solar transmission through glass for various declinations of building north line.

East Zone—Declination of the north line of a building towards the east will affect the east zone of the building in a different manner. There will be less solar transmission through glass, but peak solar transmission will occur later in the day when ambient temperatures are higher. The combined effect of lower solar transmission and higher ambient temperature may not permit much reduction in cooling requirement, but should be investigated in detail for possible savings.

Declination of the north line towards the west will reduce the cooling load on the east zone considerably, as not only will solar transmission be reduced, but the peak will occur early in the morning during a period of lower ambient temperature.

South Zone—There will be no material change in the south zone for declination of the north line towards east or west. The maximum value of solar transmission will remain the same for any declination between 45° east

TABLE I—SOLAR TRANSMISSION THROUGH GLASS FOR 40 DEGREES NORTH LATITUDE

Building North Line Declination	Approximate Maximum Value, Solar Transmission through Glass, Btu/Sq Ft	Hour of June 21 at which Peak Load Occurs (Sun Time)
30° West	133	6 p.m.
20° West	96	6 p.m.
10° West	73	6 p.m.
0°	38	6 p.m. and 6 a.m.
10° East	73	6 a.m.
20° East	96	6 a.m.
30° East	133	6 a.m.

Note: For Wood sash windows, multiply solar transmission values by 0.85. Table values based on data from ASHAE 1959 *Guide*.

or west. The only effect will be that the peak will occur at a different period. For a declination towards the east, the peak will occur late in morning, and for declination towards the west, the peak will occur late in afternoon.

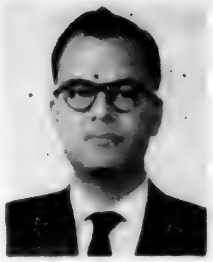
West Zone—Declination of the north line towards the east will mean a lower solar transmission later in the afternoon, coincident with lower ambient temperature, resulting in reduced cooling load. Declination towards the west has very little effect in this case. The value of peak solar transmission does not decrease much, but the period of peak tends to shift from July to October, and therefore the ambient temperature coincident with the peak will tend to be slightly lower.

Effect on Perimeter Induction System

As cooling capacity of induction units is directly proportional to the amount of primary air, the general effect of a declination of the north line from true north will be same as in case of an all-air system. As a matter of fact, the effect will be identical for a system designed without changeover. However, very few systems are designed without changeover, and the effect of the declination from north on such systems is very serious.

Usually, air requirements based on changeover considerations are about 50% more than that required for cooling alone, and therefore, any zone designed on the basic changeover considerations will need 50% more primary air than that required for cooling requirements alone.

For a declination of the north line towards the east, the east zone will tend to peak in October instead of July, and therefore the east zone in addition to the south zone will have to be designed from considerations of changeover and consequently will need a lot more air. In the same manner, declination of the north line towards the west will affect the west zone as the peak solar load will tend to occur in October, and therefore this zone will also be designed for changeover in addition to the south zone.



S. Daryanani, born India, is thirty-three years old and has a bachelor's degree in mechanical and electrical engineering from Bombay University. After four years as an air conditioning designer for Blue Star Engineering Company-Bombay, Ltd., a Worthington distributor, he accepted the position of chief engineer with Morad Behbehani, a Carrier distributor in Kuwait, Arabia. He is presently with Syska & Hennessy, Inc., Consulting Engineers, New York, N.Y., in the capacity of design engineer.

Optimum Piping for Hot Water Storage Tanks

A study of temperature distribution in a hot water storage tank, sponsored by the National Association of Plumbing Contractors, Washington, D. C., reveals that, for most uniform temperature distribution, piping from heater to overhead storage tank should enter the tank near the bottom at one end. Return piping from tank to heater should leave near the bottom of the opposite end.

Researchers F. M. Dawson and E. C. Lundquist, College of Engineering, State University of Iowa, state that a satisfactory distribution is found when the return outlet is connected near the top of the end of the tank, but only when the highest flow rate employed, 5 gpm, was used.

When piping from the water heater enters the overhead storage tank at mid-height, there is a marked variation in temperature from top to bottom, the water at the bottom being at a much lower temperature than at the top. This situation is least serious, however, when return piping from the storage tank to the water heater leaves the tank at a point near or on the bottom of the tank at the end opposite the inlet.

Temperature variation, top to bottom, is most pronounced when piping from the heater enters one end of the storage tank near the top. Large variations of temperature occur, irrespective of exit piping location.

It can be stated further, say Messrs. Dawson and Lundquist, that the line leaving the storage tank to supply water to fixtures of the system should be connected at a point on top of the storage tank and as far as possible from the end at which the inlet from the water heater is connected.

Using the recommended piping arrangement, it is possible to draw off from the storage tank a volume of uniformly high temperature water that is approximately 85% of the volume of the hot water storage tank.

For practical purposes, it is found, flow rate has little effect on temperature distribution, and the investigators conclude that the same temperature distribution obtains with forced as with natural circulation.

It is also found that the rate of heating in the water heater has no appreciable effect on the temperature distribution within the storage tank although, it is pointed out, the time required to reach a particular temperature depends upon the heating rate.

Temperature relief valves and thermostats should be located in tappings near the top of the water heater or in the outlet piping immediately above the water heater, since temperatures in the storage tank never exceed the temperatures at the water heater outlet in any test with the recommended piping arrangement. Temperatures in the storage tank do exceed temperatures at the water heater outlet in a few isolated locations for some of the poorer piping circuits.

In an uninsulated tank, even with the recommended arrangement of piping between heater and tank and the recommended location of draw-off piping, the maximum average temperature of water in the storage tank is 40-50 deg F lower than the maximum temperature reached in the water heater. Thus, if the temperature at the water heater outlet is limited to 210 deg, it will not be possible to draw off 180-deg water from the tank in amounts approaching the volume of the tank. By using an insulated tank, the draw-off temperature of 180-deg can easily be obtained without exceeding a temperature of 210 deg at the water heater outlet, the authors believe.

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Septic Tank Systems

IN all new buildings being erected, the safe and sanitary handling of sewage is an important consideration. Sewage disposal is an easy matter when street sewer facilities are available, but it becomes more difficult when such facilities are not available. When sewer facilities are not available, it becomes necessary to dispose of the waste matter on the property, in a manner that is approved by the local plumbing and health authorities. While several different disposal methods can be employed for this purpose, it is not the intent of this article to discuss the specific merits of one method over another. Instead, it covers some of the precautions that must be taken when a private disposal means is contemplated for a property. The property in this instance is the site of a small sized school of the size that is being erected in all areas of the country.

School Building

Figure 1 shows the typical school used for the example. The building, driveway, paved areas, lawns and play areas all have been shown. For sewage disposal, a septic tank, distribution box and means of leaching have been selected.

The sewage disposal system has been placed at the front of the building to simplify the connection to the street sewer in the event that such facilities are later provided. If the local community or highway department should construct a street sewer in front of the property, it would be an easy matter to disconnect the house sewer from the septic system and extend it out to the street sewer facilities.

If the septic tank is to be located in the area shown, it is first necessary to check with the local authorities and gain their precise requirements concerning the limits within which the system must be placed. Most local plumbing and health authorities have definite regulations concerning the design and installation of the proposed system as well as recommended physical dimensions that must be maintained between the components of the system and the property limits.

In this particular location in front of the building, the system is relatively safe and will not be subjected to surface loads greater than that imposed by foot traffic or grass cutting equipment. As a result, the drainage piping is not likely to settle and will offer many years of dependable service.

Other Locations

Sometimes, there is a certainty, due to the specific location of the property, that street sewer facilities will never be installed. Therefore, because of the nature of the property, it may be desired to place the disposal system at the rear of the school. When this situation is contemplated, the location of the system would be similar to that shown in Fig. 2, where it is placed directly behind the school. Since the system is in a play area, it will not be subject to loads other than that imposed by foot traffic and lawn cutting equipment.

Once again, the proposed location of the system must be approved by the local plumbing and health authorities. If there is any danger of heavy equipment passing over the piping, it may be advisable to erect a fence around the general area of the disposal system. Otherwise, it would be practical to locate the system to one side of the property, or to keep it out of the way of areas subjected to heavy loads. It is always good practice to take every precaution to safeguard a sewage disposal system and to prevent measures that could cause piping in the leaching area to sag or break, thus destroying the function of the system.

A further consideration is to so locate the disposal system that should the school expand its facilities, it can be accomplished with a minimum of alterations to the present system. In planning the disposal system, it is

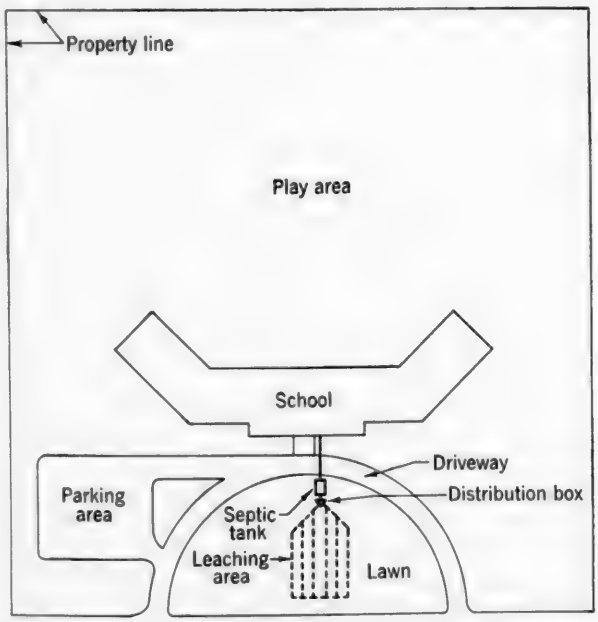


Fig. 1. Arrangement of school grounds showing the relation of the leaching area to the school.

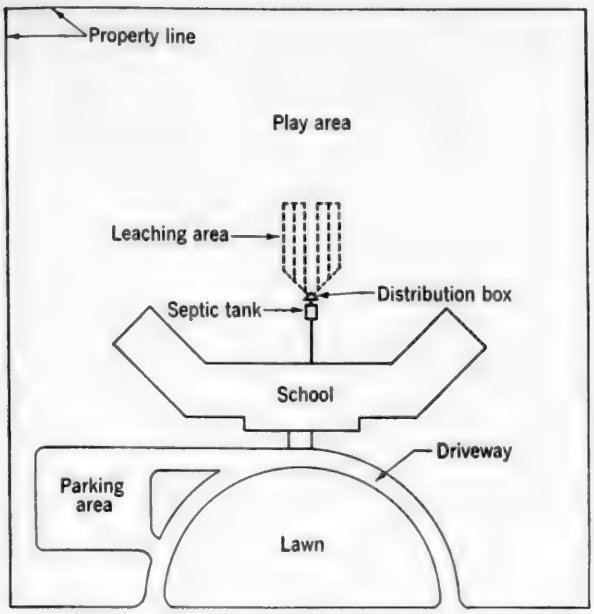


Fig. 2. Septic tank and leaching area located at the rear of a school building.

always advisable to anticipate the ultimate growth of the school and to size the septic tank accordingly. Piping in the leaching area is easily extended to accommodate an increase sewage load in the building.

Another important point to remember is that septic tanks must be cleaned periodically and therefore some provision must be made for the entry of cleaning equipment and for ease of handling. Suction apparatus is generally used for cleaning and the means and method of approach to the septic tank must be given some consideration. When the septic tank is located in front of the building, cleaning is simplified. The driveway makes it easy to spot the cleaning apparatus.

Typical Installation

As mentioned earlier, there are a number of different ways for disposing sewage on the school property. Many materials can be used for the various components of the system.

As an example, consider the system detailed in Fig. 3. The septic tank consists of a reinforced concrete structure with access covers extending up to the grade. The outlet connection utilizes a siphon device to dose the drainage piping in the leaching area. The distribution box is a concrete structure with a cover at grade. A loose baffle in the distribution box permits the waste to be directed to one section of the leaching area or the other. This device allows one section to be used while the other section drains dry. The baffle is changed in position by the maintenance man at regular intervals. The drainage piping used in the leaching area is also available in a number of different materials. The particular arrangement of the drainage piping is only for example. Other arrangements can be used to satisfy the specific needs of the system or the area in which the piping is to be installed. Each engineer will design the type of system he favors or is required by the local authorities.

The supervising authorities must be assured that the soil in which the leaching is to be disposed, is capable of handling the quantity of water that is discharged into it. The engineer must show evidence that the soil is of suitable character and that percolation tests prove that it is of good drainage capacity. This is a phase of design that should be carefully checked with the authorities.

Although Fig. 3 shows the grade sloped from the septic tank, the engineer must design his system based on the characteristics of the grade in which his proposed installation is to be made.

Seepage Pits

Another method often used in sewage disposal work is that which includes seepage pits or dry wells, as they are often called. An example of this type of system is illustrated in Fig. 4. The septic tank and distribution box are the same as that shown in Fig. 3. The exception, is the means for discharging waste water into the ground. In this case, seepage pits are used instead of the drainage piping.

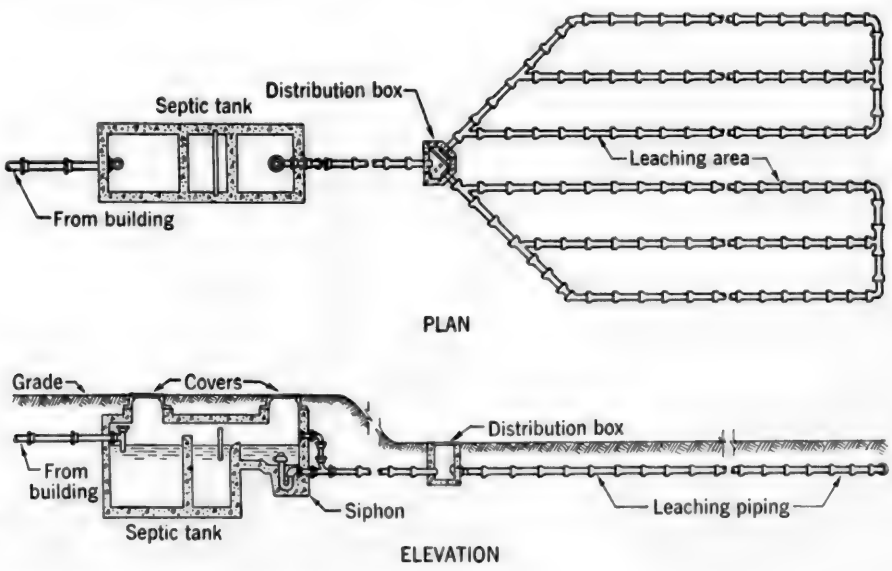


Fig. 3. Plan and elevation to show arrangement of septic tank, distribution box and leaching area.

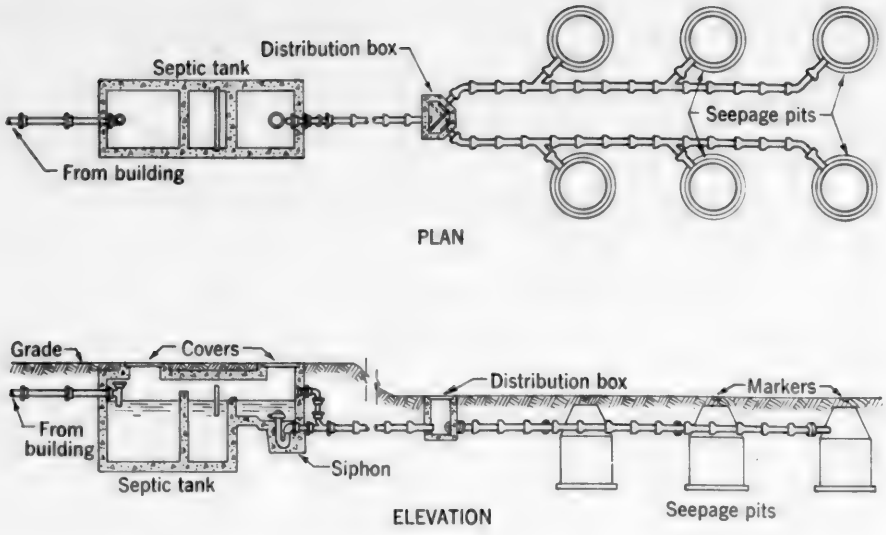


Fig. 4. Plan and elevation to show arrangement of a septic tank system utilizing a group of seepage pits.

The number of seepage pits required is determined by the quantities of waste water being disposed. The diameter and depth of the seepage pit is based upon the quantity of water to be handled and disposed of, the number of such pits that must be installed in a given area, and the characteristics of the soil in which the pits are to be installed.

Once again, the baffle in the distribution box permits one group of the seepage pits to be used while the other group is draining dry. The design and installation of this method of sewage disposal is also subject to review and approval by the local plumbing and health authorities. The cover on top of the seepage pits offers access for maintenance purposes.

Sloped Grades

Very often, sloped grades are encountered at the area selected for the leaching area. With such a condition, disposal might be accomplished by the method suggested in Fig. 5. Here the septic tank and distribution box are the same as shown in Fig. 3 and 4. However, the method of disposal varies in that the drainage piping must be so arranged to fully utilize the slope or contour of the grade in which it is to be installed.

This is accomplished by utilizing manholes at prescribed intervals, with each manhole at an elevation that best suits or conforms to the grade slope in which it is erected. Thus the drainage piping extends out from each manhole to serve as the means of disposal. The first manhole is dosed and as the capacity of the drainage piping of the first manhole is exceeded, the waste water will continue on to the next manhole to be handled by its system of drainage piping. Thus, each manhole and its component system of piping will handle its share of the load to evenly distribute the means of disposal over the entire system in a uniform manner. This type of

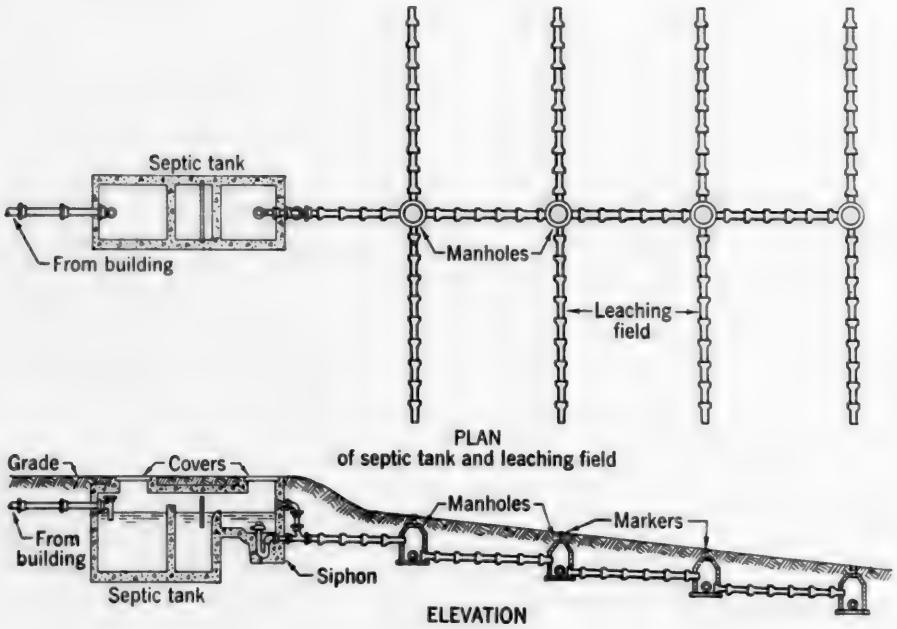


Fig. 5. Typical arrangement of a septic tank system using a leaching field for installations in sloping ground.

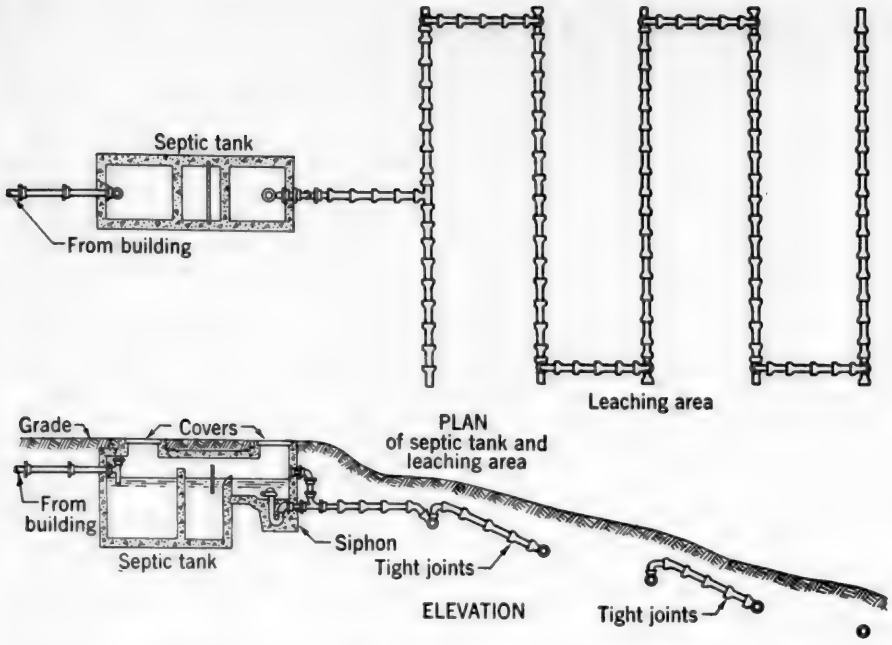


Fig. 6. Typical arrangement of a septic tank system utilizing a series distribution leaching area.

system is ideal for sloping grades where it would be impossible to install the regular kind of disposal piping.

Serial Distribution

In discussing septic tank systems, it is important to mention that comprehensive data are available on this subject in the Manual of Septic Tank Practice, published by the U. S. Public Health Service in 1957. New studies and investigations in this field are continually being made. A recent example is design data on septic tank systems which favor a new method of effluent distribution known as "serial distribution." This data was prepared by the U. S. Department of Health, Education and Welfare.

Series distribution uses separate trenches, connected in a series. All the effluent is discharged in the first trench and the overflow, so arranged that when the first trench is sufficiently dosed, the effluent will pass on to the next trench. Thus, the entire leaching area will be utilized by the system of overflows. A typical arrangement for an installation with a sloping grade would be similar to that shown in Fig. 6.

This new method resulted from research investigations conducted for the Federal Housing Administration by the Robert A. Taft, Sanitary Engineering Center of the U. S. Public Health Service in Cincinnati. The method would eliminate distribution boxes and utilize the serial distribution method. This phase of research was reported by J. B. Coulter and T. W. Bendixen, in a final report to the Federal Housing Administration. Mr. Coulter is chief, Suburban Sanitation Studies, at the Center; Mr. Bendixen is a soil scientist.

The arrangement shown in Fig. 6 gives some idea of how the new method functions. More detailed information will be available when the results of these studies are released. This is an example of the type of progress that is being accomplished by the U. S. Public Health Service, in their search for new and better ways to safeguard public health.

Plumbing Fixtures for Educational Facilities

With the publication of "Plumbing Fixtures for Educational Facilities", a special report on school washroom planning by the School Planning Laboratory of Stanford University's School of Education, an authoritative guide on correct pupil-to-fixture ratios has been established.

Recognizing the need for basic research on the subject, because of the often conflicting views of school administrators, architects and plumbing contractors, themselves, as to what constitutes adequate school washroom facilities, the Plumbing Fixture Manufacturers Association and a group of individual manufacturers both within and outside the fixture industry two years ago underwrote the study made by Stanford.

The result is a compilation of expert opinion on such matters as size, type, number and location of plumbing fixtures that will best serve both the physical needs of students and the educational program of the school.

Specific recommendations of the survey: Toilets (kindergarten through sixth grade)—boys, 1:20 (minimum), 1:40 (maximum); girls, 1:15 (minimum), 1:35 (maximum); grades seven through twelve—boys, 1:30 (minimum), 1:50 (maximum); girls, 1:20 (min.), 1:40 (max.).

Urinals (kindergarten through sixth grade)—boys, 1:15 (minimum), 1:35 (maximum); grades seven through twelve, 1:15 (minimum), 1:35 (maximum).

Lavatories (kindergarten through sixth grade)—boys, 1:25 (minimum), 1:45 (maximum); girls, the same; grades seven through twelve—boys, 1:30 (minimum), 1:50 (maximum); girls, the same.

Copies of the full report are available at $2.00 apiece through the School of Education, Stanford University, Stanford, Calif.

DEGREE-DAYS FOR JUNE, 1959

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 31st Year of Publication of Monthly Degree-Day Data

City	June			Season to June 30, incl., from Sept. 1		
	1959	1958	Normal	1958-59	1957-58	Normal
Abilene, Texas (A)	0	0	0	2834	3052	2707
Albany, New York (A)	68	118	50	7204	6696	6938
Albuquerque, New Mexico (A)	0	0	0	4117	4396	4389
Alpena, Michigan (C)	105	258	135	8148	7785	7938
Asheville, North Caroline (C)	3	4	5	4078	4730	4072
Atlanta, Georgia (A)	0	0	0	2797	3314	2826
Atlantic City, New Jersey (A)	23	41*	24*	5156	4787*	4741*
Augusta, Georgia (A)	0	0	0	2484	2936	2138
Baltimore, Maryland (C)	6	3	0	4224	4033	4203
Billings, Montana (A)	68	158	119	6902	6395	7078
Binghamton, New York (C)	67	126	48	6882	6609	6520
Birmingham, Alabama (A)	0	0	0	2839	3258	2788
Bismarck, North Dakota (A)	56	166	116	9042	8196	8967
Block Island, Rhode Island (A)	112	158	96	5915	5569	5816
Boise, Idaho (A)	43	69	92	5297	5431	5890
Boston, Massachusetts (A)	92	85	42	5962	5441	5784
Buffalo, New York (A)	63	111	72	6867	6608	6792
Burlington, Iowa (A)	9	28	34	6231	6264	6101
Burlington, Vermont (A)	97	169	72	8152	7536	7799
Cairo, Illinois (C)	0	0	0	3887	4168	3756
Charleston, South Carolina (C)	0	0	0	1851	2338	1769
Charlotte, North Carolina (A)	0	0	0	3203	3622	3205
Chattanooga, Tennessee (A)	0	0	0	3549	3903	3384
Cheyenne, Wyoming (A)	71	94	173	7175	7122	7490
Chicago, Illinois (A)	12	61	58	6261	6114	6310
Cincinnati, Ohio (C)	0	3	0	4467	4711	4532
Cleveland, Ohio (A)	43	73	46	6061	5959	5996
Columbia, Missouri (A)	3	11	14	4974	5310	5107
Columbia, South Carolina (A)	0	0	0	2614	3025	2284
Columbus, Ohio (C)	20	25	22	5502	5424	5277
Concord, New Hampshire (A)	107	167	82	7592	6920	7544
Concordia, Kansas (C)	8	11	20	5334	5555	5323
Dallas, Texas (A)	0	0	0	2444	2590	2272
Dayton, Ohio (A)	(a)	38	39	(a)	5863	5591
Denver, Colorado (A)	25	38	65	5830	5704	6116
Des Moines, Iowa (A)	15	37	45	6519	6549	6429
Detroit, Michigan (A)	34	76	60	6457	6226	6396
Devils Lake, North Dakota (C)	90	221	137	9843	8999	9832
Dodge City, Kansas (A)	3	15	15	5117	5328	5058
Dubuque, Iowa (A)	26	91	76	7535	7245	7235
Duluth, Minnesota (C)	185	304	200	9870	9248	9417
Elkins, West Virginia (A)	(a)	(a)	53	(a)	(a)	5733
El Paso, Texas (A)	0	0	0	2409	2761	2641
Ely, Nevada (A)	98	173	200	6955	7426	7377
Escanaba, Michigan (C)	103	275	166	8683	8144	8500
Evansville, Indiana (A)	0	6	0	4689	4952	4360
Fargo, North Dakota (A)	63	182	101	8969	8256	9208
Fort Smith, Arkansas (A)	0	0	0	3423	3564	3188
Fort Wayne, Indiana (A)	27	59	53	6410	6336	6270
Fort Worth, Texas (A)	0	0	0	2553	2806	2361
Fresno, California (A)	0	1	0	2032	2550	2532
Galveston, Texas (C)	0	0	0	1332	1382	1211
Grand Junction, Colorado (A)	0	0	23	5076	5371	5796
Grand Rapids, Michigan (A)	27	122	79	7071	6897	7027
Green Bay, Wisconsin (A)	72	208	107	8421	8031	8169
Greensboro, North Carolina (A)	2	0	0	3910	4321	3810
Greenville, South Carolina (A)	0	0	0	3067	3650	3060
Harrisburg, Pennsylvania (A)	23	42	14	5376	5379	5258
Hartford, Connecticut (A)	82	85	31	6443	6045	6125
Havre, Montana (C)	78	128	125	8278	7351	8155
Helena, Montana (A)	126	189	197	8070	7326	7202
Houston, Texas (C)	0	0	0	1430	1493	1276
Huron, South Dakota (A)	20	114	80	7913	7388	7876
Indianapolis, Indiana (A)	6	28	30	5766	5852	5611
Jackson, Mississippi (A)	0	0	0	2500	2839	2202
Kansas City, Missouri (A)	0	4	8	4613	5010	4888
Knoxville, Tennessee (A)	0	0	0	3637	4012	3590
La Crosse, Wisconsin (A)	33	72	74	7719	7185	7619
Lander, Wyoming (A)	74	108	163	7655	7451	8273
Lewiston, Maine (O)	169	185	45	7702	7132	7707

(a) Data not available.
* Figures based on City office readings.
Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively.

Degree-Days for June, 1959 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 31st Year of Publication of Monthly Degree-Day Data

City	June			Season to June 30, incl., from Sept. 1		
	1959	1958	Normal	1958-59	1957-58	Normal
Lincoln, Nebraska (C)	14	15	32	5697	5822	5858
Little Rock, Arkansas (A)	0	0	0	3034	3227	2982
Los Angeles, California (C)	0	0	19	707	891	1451
Louisville, Kentucky (A)	0	2	5	4408	4729	4439
Lynchburg, Virginia (A)	11	7	5	4171	4671	4153
Macon, Georgia (A)	0	0	0	2173	2607	2049
Madison, Wisconsin (A)	32	104	79	7701	7281	7260
Marquette, Michigan (C)	145	253	189	8413	8072	8373
Memphis, Tennessee (A)	0	0	0	3219	3618	3137
Meridian, Mississippi (A)	0	0	0	2577	2810	2333
Milwaukee, Wisconsin (A)	73	165	109	7475	7315	7153
Minneapolis, Minnesota (A)	28	106	80	7594	7329	7828
Moline, Illinois (A)	8	41	45	6450	6555	6356
Montgomery, Alabama (A)	0	0	0	2173	2615	2137
Nashville, Tennessee (A)	0	1	0	3757	4152	3513
New Haven, Connecticut (A)	68	101	52	6054	5783	6008
New Orleans, Louisiana (C)	0	0	0	1298	1555	1175
New York, New York (C)	43	32	18	5153	4941	5050
Newark, New Jersey	27	25	11	5179	5015	5252
Norfolk, Virginia (A)	4	7	0	3343	3706	3454
North Platte, Nebraska (A)	22	56	59	6445	6775	6529
Oak Ridge, Tennessee (C)	0	0	0	3916	4065	4028
Oakland, California (A)	70	18	119	2137	2413	3002
Oklahoma City, Oklahoma (A)	0	3	0	3887	4142	3519
Omaha, Nebraska (A)	14	15	32	6097	6076	6155
Parkersburg, West Virginia (C)	23	20	13	5023	5198	4750
Peoria, Illinois (A)	5	35	41	6112	6087	6076
Philadelphia, Pennsylvania (C)	12	15	0	4632	4603	4523
Phoenix, Arizona (A)	0	0	0	1115	1437	1492
Pittsburgh, Pennsylvania (C)	30	45	13	5288	5342	5048
Pittsfield, Massachusetts (A)	114	202	105	7699	7379	7606
Pocatello, Idaho (A)	75	61	136	6358	6613	6976
Portland, Maine (A)	187	206	117	7872	6980	7610
Portland, Oregon (C)	84	48	70	3815	3558	4116
Providence, Rhode Island (A)	88	114	58	6161	5783	6099
Pueblo, Colorado (A)	10	17	27	5410	5293	5709
Raleigh, North Carolina (A)	4	1	0	3550	3938	3075
Rapid City, South Dakota (A)	47	121	148	6988	6686	7479
Reading, Pennsylvania (C)	16	27	11	5153	5088	5055
Red Bluff, California (A)	0	0	0	1920	2799	2546
Reno, Nevada (A)	58	139	165	5489	5799	5948
Richmond, Virginia (A)	10	6	0	3923	4320	3955
Rochester, New York (A)	67	131	54	7040	6783	6820
Roswell, New Mexico (A)	0	0	0	3551	3637	3424
Sacramento, California (C)	0	2	5	1827	2494	2600
St. Joseph, Missouri (A)	3	9	11	5426	5663	4703
St. Louis, Missouri (C)	0	4	7	4519	4799	4469
Salt Lake City, Utah (A)	34	13	81	5297	5525	5866
San Antonio, Texas (A)	0	0	0	1768	1816	1579
San Diego, California (A)	0	0	43	701	849	1556
Sandusky, Ohio (C)	11	53	41	6092	6015	5859
San Francisco, California (C)	165	73	180	2062	2242	2703
Sault Ste. Marie, Michigan (A)	167	329	224	9398	8721	9240
Savannah, Georgia (A)	0	0	0	1884	2409	1710
Scranton, Pennsylvania (A)	55	118	35	6547	6526	6029
Seattle, Washington (C)	104	46	107	4102	3570	4344
Sheridan, Wyoming (A)	83	168	161	7705	6961	7835
Shreveport, Louisiana (A)	0	0	0	2392	2472	2117
Sioux City, Iowa (A)	21	35	54	6839	6597	6987
Spokane, Washington (A)	131	76	146	6504	5849	6807
Springfield, Illinois (A)	2	23	14	5568	5705	5225
Springfield, Missouri (A)	9	11	16	4598	4929	4685
Syracuse, New York (A)	66	(a)	37	7082	(a)	6491
Toledo, Ohio (A)	31	70	60	6508	6369	6382
Topeka, Kansas (C)	4	10	13	5194	5111	4919
Trenton, New Jersey (C)	23	34	11	5171	5007	5068
Tulsa, Oklahoma (A)	0	0	0	3606	3878	3584
Utica, New York (O)	59	131	0	6942	6781	6796
Valentine, Nebraska (A)	33	83	83	7224	7008	7054
Walla Walla, Washington (C)	31	15	38	4586	4227	
Washington, D. C. (C)	11	0	0	4213	4474	4258
Wichita, Kansas (A)	0	8	7	4689	4992	4571
Williston, North Dakota (C)	69	173	138	8915	8022	8997
Winnemucca, Nevada (A)	61	122	111	6099	6249	6352
Yakima, Washington (A)	101	34	53	5905	5289	5838

For footnotes, see page 94.

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Same System Refrigerates Ice Rink And Air Conditions New Motel

An unusual refrigeration system to air condition a 250-room motel in the summer, and with the same equipment supply brine for an ice skating rink in the winter, has been furnished by Acme Industries, Inc., Jackson, Mich. This was accomplished at the new and luxurious Empress Motel in Atlantic City, N. J.

The manufacturer designed two special Model DD-50 (50 ton capacity) combination packaged chillers, with

each inter-connected to a special AT-50 cooling tower. This equipment made it possible to install a system that is both simpler and less costly than contemplated in original plans and estimates, namely, the use of separate coolers for supplying calcium chloride brine for the skating rink and chilled water to the fan-coil units for air conditioning.

The Empress Motel is constructed on stilts with the ground floor serving as parking lot. The boiler and equipment room is located in one corner of the parking lot, which is just beneath the shallow part of the swimming pool. Refrigeration equipment and cooling towers are located in the equipment room. The second floor is actually the ground floor of the motel, where the ice skating rink, swimming pool and lounges are located. The ice skating rink is constructed of steel pipes embedded in a concrete slab. During the summer season the ice skating rink is used as a dance floor and veranda.

During winter months the swimming pool is enclosed with a balloon-canopy, providing pleasant year-round use, which can be inflated in 27 minutes. The ends of the canopy are of blue nylon with vinyl coating and the body of the balloon is transparent mylar. A revolving door serving as an entryway also functions as an airlock in the 110-ft long, 20-ft high and 40-ft wide inflated structure.

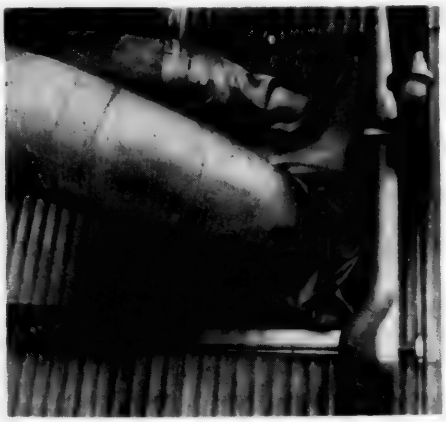
Convector radiation heats the interior of the balloon enclosure and a special glass-enclosed and well-heated corridor leads to the pool entry, making it possible for guests to enter the pool from their rooms in bathing suits without going outdoors.

Fabric Weatherproofs Wall Openings For Steam and Water Pipes

South Carolina Electric and Gas Co. has made novel use of Neoprene-coated nylon fabric when it was tried and found successful for weatherproofing wall openings through which steam and water pipes enter the new McMeekin Steam Electric Generating Station.

A rigid arrangement is impossible for this purpose, because the pipes expand and contract with varying temperatures, and they may move as much as three inches in any one direction. A flexible material is, therefore, the solution. However, some of the materials used elsewhere did not last long; they did not stand up to the relatively high temperatures and humidity present, and they rotted and tore under the stresses exerted by the moving pipe.

To provide a more lasting weatherproofing, the Columbia Tent & Awning Co., a local canvas fabricator, suggested Neoprene-coated Coverlight-N, a synthetic rubber-



coated nylon fabric made by the Vulcan Rubber Products Div., Reeves Brothers, Inc., New York.

After field testing the material for durability and heat resistance, the construction consultant for the new station commissioned the canvas fabricator to make 12 fitted wall-opening covers, in sizes 6 by 9 ft and 7 by 9 ft. Total cost including labor for the installation was about $650. The material is held around the pipes with clamping bands and secured to the walls with clamping flanges and strips.

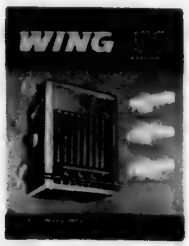
NEW LITERATURE

Use the prepaid postcard on last page for securing your copies of these catalogs.

New Wrought Iron

Mn wrought iron, a specialty alloy wrought iron containing approximately 1% manganese, is described in an 8-page booklet available from A. M. Byers Co., Pittsburgh, Pa. Booklet contains charts showing metal's improved impact resistance at sub-zero temperatures.

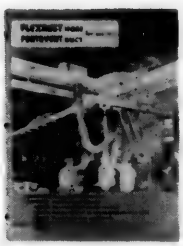
Circle **Item 1** on Inquiry Card



Gas-Fired Duct Heaters

Bulletin GD-100, from L. J. Wing Mfg. Co., Linden, N. J., describes a line of gas-fired duct heaters which provide efficient automatic heating in commercial and industrial fields. It also describes compact blower assemblies, both encased and open, for use with the unit heaters.

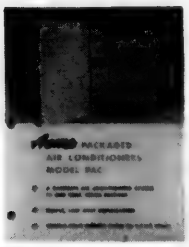
Circle **Item 2** on Inquiry Card



Fume Control

Uses of the company's Flexaust hose and Portovent duct in fume control applications are described and illustrated in Bulletin 84, published by The Flexaust Co., New York, N. Y. In addition, material specifications and construction details are given, plus selection data.

Circle **Item 3** on Inquiry Card



Packaged Air Conditioners

An 8-page bulletin, Catalog No. 570, is published by Acme Industries, Inc., Jackson, Mich., describing its complete line of Model PAC packaged air conditioners. Bulletin gives construction details, dimensions, model designations, cooling capacities, compressor motor horsepower, and other data.

Circle **Item 4** on Inquiry Card

Electrical Engineering Data

A booklet, Convenient Tables and Formulas, is published by Westinghouse Electric Corp., Pittsburgh, Pa. Booklet B-3677D includes 120 pages of tables, formulas, and graphical symbols summarizing electrical data, properties of materials, heat transfer and steam information.

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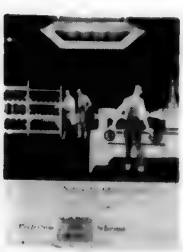


Infra-Red Gas Heaters

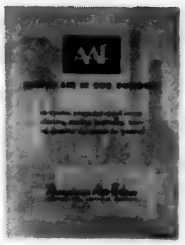
Controlled heating comfort without ducts, blowers, or heat exchangers is the claim for Schwank infra-red gas heaters manufactured under license by Perfection Industries, Cleveland, Ohio, division of Hupp Corp. 8-page bulletin describes various models, and gives installation, control data.

Circle **Item 6** on Inquiry Card

Centrifugal Pumps for Air Conditioning

How design of the company's centrifugal pumps provides better service in an air conditioning system is the theme of a bulletin published by Worthington Corp., Harrison, N. J. Bulletin 2000-B3 tells how to select the proper pump for use in air conditioning systems.

Circle **Item 7** on Inquiry Card



Products for Better Air

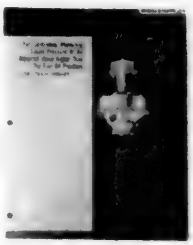
Emphasizing the fact that optimum environment for any plant or building can be coordinated and controlled because of its complete "family" of products and services, American Air Filter Co., Inc., Louisville, Ky., offers Bulletin No. 518 which describes these products.

Circle **Item 8** on Inquiry Card

Small, High Efficiency Meters

A 12-page bulletin, GEA-6882, with an inserted 4-page technical data bulletin, discusses features and points out advantages of new Unitized motors manufactured by General Electric Co., Schenectady, N. Y. Technical bulletin gives construction features, performance, mechanical variations.

Circle **Item 9** on Inquiry Card



Differential Pressure Regulators

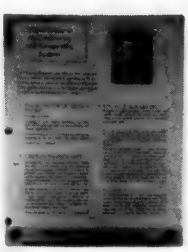
An illustrated catalog sheet, available from Atlas Valve Co., Newark, N. J., describes two new differential pressure regulators for steam service. It contains photographs, lists of materials, ordering information, features, installation data, and method of operation of both valves.

Circle **Item 10** on Inquiry Card

Packless Expansion Joints

Adsco Div., Yuba Consolidated Industries, Inc., Buffalo, N. Y., offers 76-page Bulletin No. 59-50. Corruflex packless expansion joints, for high and low pressures and temperatures, are described, with complete installation data and comprehensive tables of forces, movements and dimensions.

Circle **Item 11** on Inquiry Card

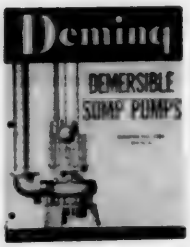


Cooling Water Treatment

Literature on the treatment of water in central air conditioning systems is published by Water Service Laboratories, Inc., New York, N. Y. The question and answer bulletin includes hints on corrosion and scale prevention, problems in closed circulating systems, and control of slime.

Circle **Item 12** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.



Submersible Sump Pump

The Deming Co., Salem, Ohio, offers an informative 8-page bulletin describing firm's new submersible sump pump, called the Demersible. Features of both motor and pump are presented in addition to performance tables, dimensions, optional equipment, and installation data.

Circle **Item 13** on Inquiry Card

Pyrometric Equipment

A product catalog, published by Thermo Electric Co., Inc., Saddle Brook, N. J., describes the company's lines of thermocouples, thermocouple wire, and instrumentation for temperature measurement and control. Pyrometric equipment is illustrated, and specifications are provided.

Circle **Item 14** on Inquiry Card

Flush Valves

The complete line of Watrous flush valves is described in 52-page Catalog No. 459, available from The Imperial Brass Mfg. Co., Chicago, Ill. In addition, there are 73 roughing-in illustrations with accompanying technical data that will simplify selection of the proper flush valve.

Circle **Item 15** on Inquiry Card

Seamless Welding Fittings

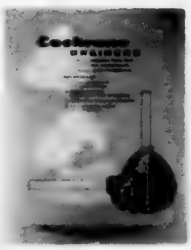
A 12-page booklet, FB-78, offered by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa., is a guide to material selection of carbon, alloy and stainless steel welding fittings and flanges. It covers specifications and analyses, and arc welding procedures.

Circle **Item 16** on Inquiry Card

Air Filters and Humidifiers

The company's lines of air filters and humidifiers are described in a catalog which is available from Research Products Corp., Madison, Wis. Products include residential and industrial humidifiers, air filters, and grease filters. Interspersed with product information are design data.

Circle **Item 17** on Inquiry Card



Continuous Discharge Drainers

Operation and applications of continuous discharge drainers are discussed in Publication 5201-A, published by Cochrane Corp., Philadelphia, Pa. Drainers described are of ball-float-actuated rotary valve design and are recommended for steam, compressed air and gas service.

Circle **Item 18** on Inquiry Card

Cabinet Unit Heaters

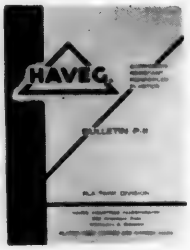
Bulletin No. 351, issued by McQuay, Inc., Minneapolis, Minn., describes its line of cabinet unit heaters. Bulletin covers both general and mechanical design, presents comprehensive charts and tables for steam and hot water capacity ratings, and shows various unit arrangements.

Circle **Item 19** on Inquiry Card

Heating and Cooling Equipment

Residential and commercial equipment for year-round air conditioning comfort is offered under the name Western by Tuck-Aire Furnace Co., San Francisco, Calif. A 6-page bulletin illustrating and describing these units is offered by the manufacturer. Unique heat exchanger is featured.

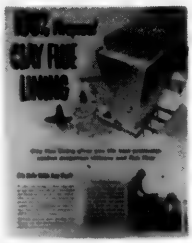
Circle **Item 20** on Inquiry Card



Corrosion-Resistant Reinforced Plastics

Haveg Industries, Inc., Wilmington, Del., announces 28-page Catalog P-11 which describes the wide range of applications of Haveg polyester-glass industrial corrosion-resistant equipment. It includes tables of physical properties and provides equipment application and selection data.

Circle **Item 21** on Inquiry Card



Safe Chimney Construction

Standard recommendations for safe chimney construction, complete with drawings and ASTM specifications, are contained in a revised 6-page bulletin offered by Clay Flue Lining Institute, Akron, Ohio. It gives advantages, explains how clay flue lining makes homes and buildings fire-safe.

Circle **Item 22** on Inquiry Card

Temperature Controls

An 8-page condensed catalog of temperature controls and allied equipment for industrial heating and refrigeration is issued by The Partlow Corp., New Hartford, N. Y. Catalog lists recording, indicating, and non-indicating controls; thermometers; and bulb installation accessories.

Circle **Item 23** on Inquiry Card

Integrally-Traced Piping

Two publications, available from Aluminum Company of America, Pittsburgh, Pa., cover Unitrace, the company's integrally-traced aluminum piping. An 8-page booklet, illustrated, describes fittings designed to simplify Unitrace applications. A 25-page report gives design, installation data.

Circle **Item 24** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Dust Control

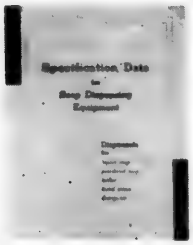
New data on dust control with the company's cyclone separators are available from Torit Manufacturing Co., St. Paul, Minn. Literature shows how one or a combination of cyclone separators can provide effective dust control throughout a wide range of applications.

Circle **Item 25** on Inquiry Card

Double Retort Underfeed Stokers

Catalog No. 401 gives complete data on the double retort underfeed stoker manufactured by Detroit Stoker Co., Monroe, Mich. This stoker is built for heavy duty service in the intermediate size range for boilers from 20,000 to 34,000 lb steam per hr capacity. Typical installations shown.

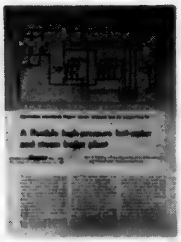
Circle **Item 26** on Inquiry Card



Soap Dispensing Equipment

Bobrick Dispensers, Inc., Brooklyn, N. Y., announces a revised edition of its booklet, Specification Data for Soap Dispensing Equipment. Booklet is designed to provide everything one needs to know to properly specify soap dispensing equipment for any building. Selector guide is included.

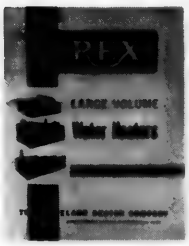
Circle **Item 27** on Inquiry Card



Boiler Plant Modernization

J. O. Ross Engineering Div., Midland-Ross Corp., New York, N. Y., offers a 4-page reprint of a technical article which tells how one company modified its high-pressure hot-water generating plant to enable it to produce both steam and high-pressure hot water.

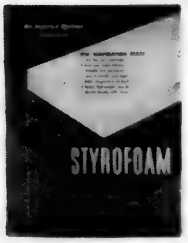
Circle **Item 28** on Inquiry Card



Large Volume Water Heaters

How to design, specify, and buy water heater and storage systems is covered in the 24 pages of Catalog No. CH-650, published by The Cleveland Heater Co., Cleveland, Ohio. This booklet also provides complete specifications on the Rex line of large volume water heating equipment.

Circle **Item 29** on Inquiry Card



Insulation Applications

Plastic Sales, The Dow Chemical Co., Midland, Mich., offers four reports: Bulletin 157-43 on Scorbord, for perimeter insulation; Bulletin 157-49 on Styrofoam, as an insulation-plaster base; Bulletin 157-51 on pipe and vessel covering; Bulletin 157-50 on low temperature space insulation.

Circle **Item 30** on Inquiry Card

Louvers and Dampers

Precision constructed dampers, louvers, and shutters for general construction, heating, ventilating and air conditioning are illustrated in a catalog available from Arrow Louver & Damper Corp., Brooklyn, N. Y. Items include extruded aluminum, steel, galvanized or copper units.

Circle **Item 31** on Inquiry Card

Emergency Showers

Bulletin No. 59, from Logan Emergency Showers, Inc., Glendale, Calif., illustrates and describes the original multi-spray emergency shower with swinging gate actuator for laboratory, plant or field use. It includes indoor, outdoor, frost-proof, portable and mobile models with optional eyewash.

Circle **Item 32** on Inquiry Card

Corrosion-Resistant Valves

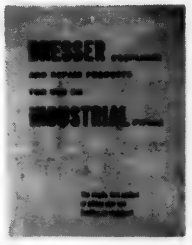
Bulletin No. 11 describes stainless steel valves, with replaceable Teflon discs or seats, manufactured by Alloy Steel Products Co., Inc., Linden, N. J. Bulletin covers a complete line of valves, and provides extensive data and application information in its 8 pages.

Circle **Item 33** on Inquiry Card

Integral Horsepower Motors

Complete information concerning the company's newly-designed, drip-proof, splash-proof, weather-proof integral horsepower electric motors is contained in Brochure No. SB-186, available from Marathon Electric Manufacturing Corp., Wausau, Wis. Data include ratings, dimensions.

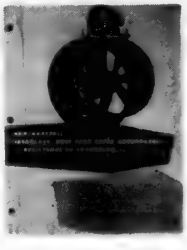
Circle **Item 34** on Inquiry Card



Couplings for Industrial Piping

Use of the manufacturer's couplings, fittings and other piping products for industrial piping is described in an 8-page catalog, Form No. 259, published by Dresser Manufacturing Div., Dresser Industries, Inc., Bradford, Pa. It contains product information, installation instructions.

Circle **Item 35** on Inquiry Card



Fiberglass Duct Fans

A new line of fiberglass belt-drive duct fans, said to offer exceptional resistance to most corrosive elements common to industrial plants, is described in Bulletin A-116, published by Hartzell Propeller Fan Co., Piqua, Ohio. Performance data are included in 2-page bulletin.

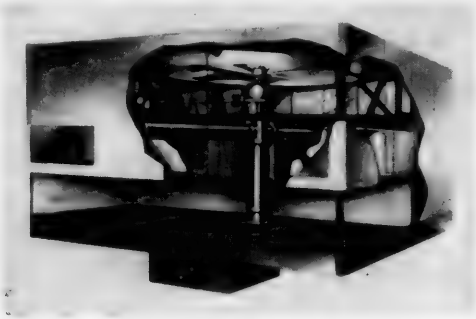
Circle **Item 36** on Inquiry Card

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

High-Capacity Cooling Towers

A new type of large-capacity cooling tower was introduced by Carrier Corp., Syracuse, N. Y., at the Engineering Progress Exposition. The towers are smaller and weigh far less than conventional models of similar capacity, according to a company spokesman. Flat, almost totally enclosed sides, instead of the customary louvers, permit blending the tower with the building exterior or using it for advertising purposes.

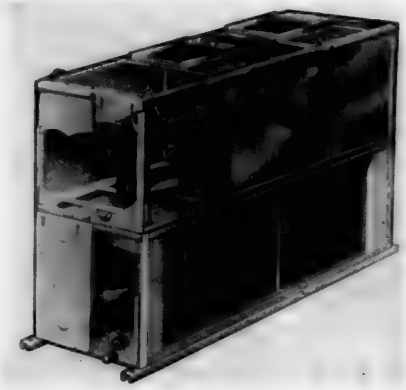


The new "fill" material, used in an 18-inch-thick layer inside the tower, allows water to evaporate, thus carrying away heat more effectively than the "egg crate" grid construction now commonly employed, and takes only one-fourth the space, according to the company. The "fill" is made of pressed wood fibers in a porous honeycomb pattern impregnated with phenolic resins. Years of testing has shown it resistant to aging, chemical deterioration, and deposit of scale from the water.

Tower is produced in nine sizes between 170 and 500 tons cooling capacity. Larger tonnages can be handled by multi-cell arrangements.

More information? Circle Item 37, postcard, last page.

Conditioner Line Expanded



Design, performance, and service-feature changes to its line of central station air conditioning equipment for single-zone applications are announced by Drayer Hanson, Div. of National-U. S. Radiator Corp., Los Angeles, Calif.

The line now includes thirty models, of both vertical and horizontal types. Each type now is available in capacities of 500 through 35,000 cfm. The number of models is expanded to a total of 15 each. A new construction permits full access from any exposed side of the unit, with extra-large access door provided.

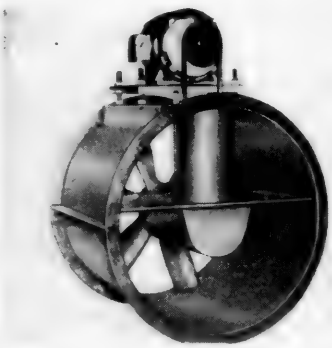
The company is internally mounting both motor and drive within the fan section. The drain pan, 2 inches deep, and connections have been placed at both ends of the unit. Two permanently lubricated self-aligning bearings per shaft are used to alleviate any possibility of misalignment. Fans are forward curve, DIDW, cast iron center-hub type.

Coincidental with the redesigning, the company will make available to qualified inquirers, a set of new fan-performance curves. This set of charts will allow the user to determine instantly from a single point the motor horsepower, cfm, system characteristic, static pressure and outlet velocity. The time-saver tables will also allow for accurate performance predictions for multi-speed operation, and will provide a simplified method of establishing corrected fan rpm in a given installation.

More information? Circle Item 38, postcard, last page.

Fiberglass Duct Fans

A line of all-fiberglass belt-drive duct fans which, the company says, in many applications offer resistance to corrosion equal to or exceeding that of all-stainless steel or all-monel units at substantially lower cost, has been introduced by the Hartzell Propeller Fan Co., Piqua, Ohio.



Propeller, duct section, drive housing and bearing cover on these new fans are fiberglass; drive shaft and hardware are made of stainless steel.

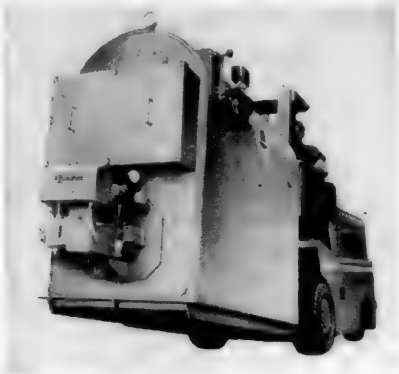
In design and performance, the new line is identical to the company's standard belt-drive duct fans and offers the same features, including variable pitch drives which allow quick, easy adjustment of fan speed, fan noise and air delivery. Fans are in 20, 24 and 28-inch dia.

More information? Circle Item 39, postcard, last page.

Forced-Draft Package Boilers

A new line of Kewanee Square Heat packaged commercial and industrial boilers, which features forced-draft firing, is available from American-Standard Industrial Division, Detroit, Mich.

Designated Type RF units, the packages cover a range of SBI net ratings (steam) from 1010 to 5620 sq ft, and water from 243 to 1350 Mbh. The forced-draft burner



fires natural, mixed or LP gas, No. 1 or No. 2 fuel oil, or combination gas and oil. The burner and all controls are installed and wired at the factory.

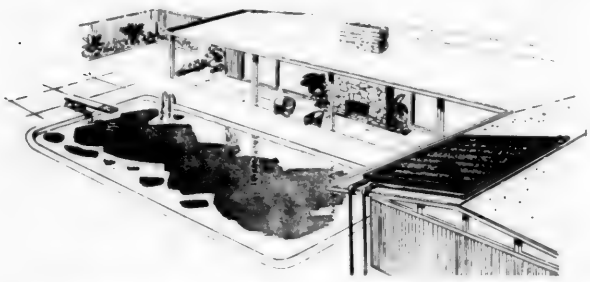
The package is a completely assembled unit; only service connections are required to complete the installation.

One important feature of the units is a front-mounted control panel that provides a selector switch for instant fuel change-over on combination units. In addition to conventional safety controls, an air-flow safety switch delays firing until the forced draft blower is operating at correct speed.

More information? Circle Item 40, postcard, last page.

Solar Heating for Pools

Year-Round Comfort, Inc., Studio City, Calif., announces what is described as a sensible approach to solar heating the swimming pool. Asserting that it is not economically feasible to design a large solar collection panel which will follow the sun to gain maximum efficiency, the company has taken the approach of producing cheaper, smaller, separate panels that can be joined together, so that the total panel area may be made any desired size.



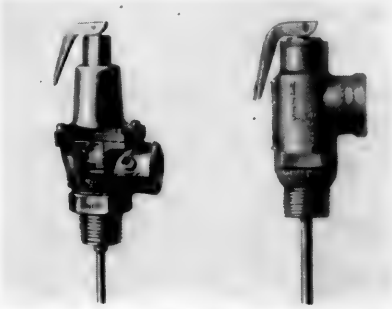
These panels are made complete with housing, insulation, Revere copper tube-in-strip collector panel, and DuPont Mylar cover. Each panel is 16 inches wide and 10 ft long, providing 12½ sq ft of area. Panels can be joined together with simple tools, and can be installed on a roof, as illustrated, or a fence.

The most economical installation takes water directly from the pool filter pump, and uses this with a by-pass to force part of the water up through the collector when heat is desired. These panels are designed with a low pressure drop, and when a minimum amount of supply and return piping to the panel is used, it will not require increasing the filter pump size.

More information? Circle Item 41, postcard, last page.

Relief Valves Meet New Standards

Watts Regulator Co., Lawrence, Mass., announces two valves conforming to the new 1959 FHA Minimum Property Standards. They are No. 40XL, ASME, AGA-listed self-closing temperature and pressure relief valve (at left in photo), and No. 4XL, AGA-listed self-closing tempera-



ture and pressure relief valve, shown at right. Both have been tested and rated in compliance with the new ASA Z21.22-1958.

The company offers a packaged kit containing brochures on these valves and information dealing with the new FHA requirements.

More information? Circle Item 42, postcard, last page.

Industrial Air Processing Units

To fulfill the need in many industrial processes for air at temperatures below 40 deg F and humidities below 40%, Rempe Co., Chicago, Ill., has announced a line of air units available in capacities from 2 tons upwards and suitable for producing air temperatures of 38 to 300 deg and all combinations of humidity requirements.

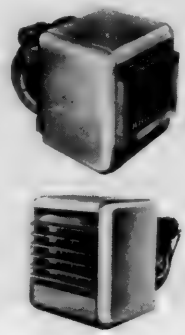
These air units include the direct expansion coil, reheat coils where necessary, blower, filters, and blower motors. Coils are normally supplied with copper tube for the Freon refrigerants and chilled water. Steel galvanized coils can be furnished for use with ammonia. For special applications, the coils can be furnished in stainless steel.

Each unit is designed and built for the particular application. The company invites the opportunity to discuss any air handling system which presents a problem.

More information? Circle Item 43, postcard, last page.

Gas-Fired Unit Heaters

Gas-fired unit heaters with slow-speed centrifugal blowers are available from Sturtevant Div., Westinghouse Electric Corp., Boston, Mass., in two types—free delivery units with adjustable louvres (Type FD), at bottom in photo, for effective air distribution in the proximity of the unit, and ductwork units (Type DW), at top, for distribution to remote areas.



The centrifugal-blower units have been designed for heating applications where large volumes of air must be moved quietly, such as in schools, libraries, churches and offices.

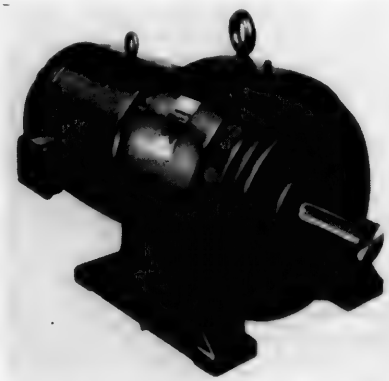
Eight models allow a choice of output ratings from 40,000 to 200,000 Btu per hr.

More information? Circle Item 44, postcard, last page.

Enclosed Gear Drives

Enclosed gear drives to meet the majority of application requirements for speed reduction units 125 hp and smaller, with output speeds ranging from 780 to 1.2 rpm at 1750 rpm input speed, are announced by Wagner Electric Corp., St. Louis, Mo. Drives are rated in accordance with all applicable standards of the American Gear Manufacturers Association.

Duti-Rated helical gears, heat-treated after cutting by a special process to obtain maximum hardness, give high capacity, great shock resistance and extra wear life, the company states. Unit-type housings of corrosion-resistant cast iron have the output shaft endplate and the mounting feet or flange cast as integral parts for strength and rigidity. Extra capacity bearings give high overhung load ratings. Splined assembly of the drive pinion to the input shaft assures accurate alignment.



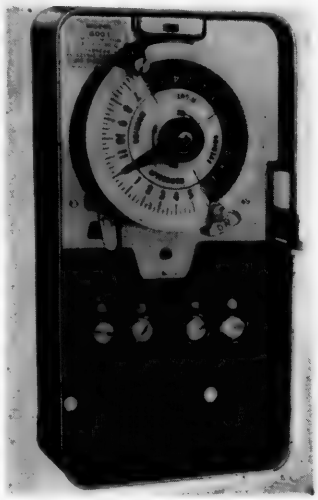
Foot-mounted, flange-mounted and extended flange straight-line units are available as integral-type gearmotors, with the motor and speed reducer forming an integral assembly; as all-motor gearmotors, with a standard motor coupled to the input shaft of the speed reducer; and as separate speed reducer units. The latter can also be furnished for right-angle drive.

Space-saving, shaft-mounted reducers, for mounting directly on the shaft for the driven equipment, are also available in ratings through 40 horsepower.

More information? Circle Item 45, postcard, last page.

Forty-Ampere Time Switch

A 40-amp, tungsten-rated time switch, Series 4000, for all lighting applications from incandescent to neon and for use with pumps, blowers, motors, heating and air-conditioning, plus many other industrial and central station uses, is announced by Paragon Electric Co., Two Rivers, Wis.



Significant development of this switch, the company states, is its 40-amp tungsten rating which provides the highest capacity available in general purpose low-cost time switches. The 40-amp rating is said to eliminate all troubles caused by "contact welding" and introduces a new concept in switching mechanism with free-floating make-and-break contacts.

A quick-set dial uses easy-add trippers, and is calibrated in 15-min sections and subdivided into 6-hr quadrants, *morning*, *afternoon*, *evening*, and *night*. For skip-a-day applications, an omitter device is available in all switch arrangements.

More information? Circle Item 46, postcard, last page.

Electric Heating Equipment

A line of electric heating products for residential and commercial use is announced by The Emerson Electric Mfg. Co., St. Louis, Mo.

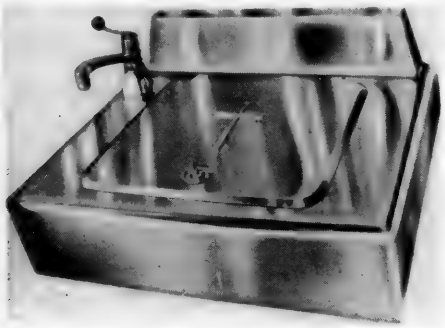
Featured is a packaged heat pump, the Northwind Reversible, in two sizes for in-the-wall or window mounting. One-horsepower unit provides 10,000 Btu of heat at zero deg F to 13,300 Btu at 45 deg, and 11,000 Btu of cooling. The 2-hp unit provides 10,000 Btu of heat at zero deg to 17,100 Btu at 45 deg, and 17,000 Btu of cooling. Auxiliary resistance heaters maintain heating capacity at low outside temperatures.

Other products include the Emerson-Pryne lines of automatic electric wall insert heaters; radiant heat cable; baseboard electric heaters; and infra-red, radiant and conventional electric heaters for ceiling mounting.

More information? Circle Item 47, postcard, last page.

Space-Saving Stainless Piscina

Model B-24062 piscina is added to its line of equipment for religious buildings by Just Mfg. Co., Franklin Park, Ill. The company is a manufacturer of stainless steel equipment, and its line includes sacrarium sinks,



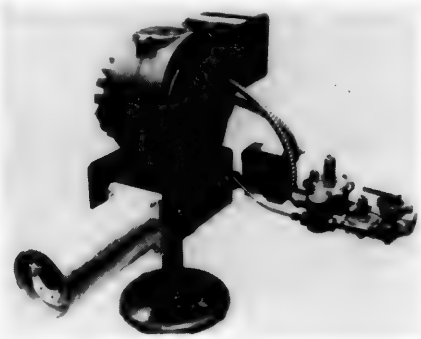
drinking fountains, holy water fonts, and custom stainless cabinetry.

The piscina is fabricated of 18-8 stainless steel and was designed for installation where space is an important factor, being only 23 inches long. The unit is designed to be wall hung.

More information? Circle Item 48, postcard, last page.

Packaged Blast Burner

Incino-Flame is a packaged fan-type gas burner, completely piped and wired and ready to install by Bryant Industrial Products Corp., Cleveland, Ohio. The unit is used on incinerators, ovens, air heaters, furnaces and for miscellaneous heating applications. Its nozzle-mix burner does not require a refractory combustion tunnel and its blast pilot will not blow out, the company states.



Unit employs simple, foolproof, field-tested, approved controls, said to assure low maintenance. Both fan and motor are larger than usual, yet the unit is competitively priced.

Three control options are offered: manual, semi-automatic, and fully automatic. Manual and thermoelectric control (semi-automatic) models utilize flash-tube ignitor and constant-burning pilots whose hot-wire coils will not burn out. Automatic-control units have electronic flame safety and include spark ignition of cycling pilots. The pilot burner for all models is stabilized for either high or low-draft conditions. Though no baffles or air shields are used, the pilot flame will not blow out.

Burner is available in two capacity ranges, each providing a minimum of 50,000 and maximums of 450,000 or 600,000 Btu per hr. Units are available for all types of commercial fuel gases, including liquefied petroleum. An adjustable orifice controls heat output. Fan motors are 115v, 60 cycle. All units have pilot and pressure regulators. Four optional mountings are offered: pedestal and base, refractory block and holder, straight ring-mounting flange, or 10° ring-mounting flange.

More information? Circle Item 49, postcard, last page.

Pressure-Vacuum Control

United Electric Controls Co., Watertown, Mass., offers two pressure-vacuum controls, designated Type J27 (uncalibrated) and Type H27 (calibrated). These controls, the company states, were developed to meet the demand for a low cost, highly sensitive (switch differential of $\frac{3}{4} \pm 1$ inch of water, and up) instrument.

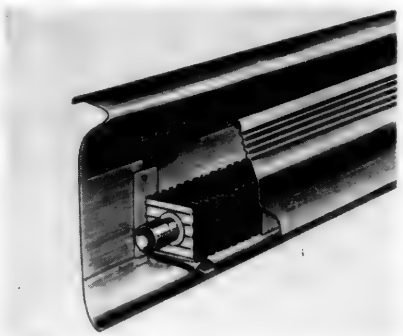
Several models are available within range limits of 30 inches of mercury vacuum and 15 psi. The control may be calibrated (knob and dial) or uncalibrated, and may incorporate stainless steel or beryllium bellows. The enclosure is die cast aluminum with black wrinkle finish. Approximate weight is 2 lb.

Many types of switches are available including normally open, normally closed, or double throw with no neutral position, and are rated 3 amp, 115/230 volts a-c. All switches are single pole and suitable for ambient temperatures up to 180 deg F.

More information? Circle Item 50, postcard, last page.

Simulated Wood Baseboard Cover

Edwards Engineering Corp., Pompton Plains, N. J., announces a simulated wood-grain baseboard cover, called Acousti-Cover, for use in wood-panelled living rooms, dens and recreation rooms. Covers are also available in copper-tone, chrome and flat white.



Covers are offered in factory-cut, unbroken lengths from 2 to 20 ft for wall-to-wall installation. This eliminates the need for unsightly mid-room splicing, and aids rapid installation.

Baseboard elements come in $\frac{1}{2}$ and $\frac{3}{4}$-inch nominal tube sizes, plus high-capacity units, in a variety of industry-approved ratings.

More information? Circle Item 51, postcard, last page.

Mass Exhaust Roof Ventilator

A new type of mass exhaust roof ventilator is announced by Western Engineering & Mfg. Co., Venice, Calif. Designed especially for heavy industrial applications requiring the removal of vast quantities of gases, smoke, fumes, and contaminated air, this ventilator exhausts by the convection current principle, quietly and efficiently, without the high cost of electrical installation, operating or maintenance expense, according to the manufacturer.

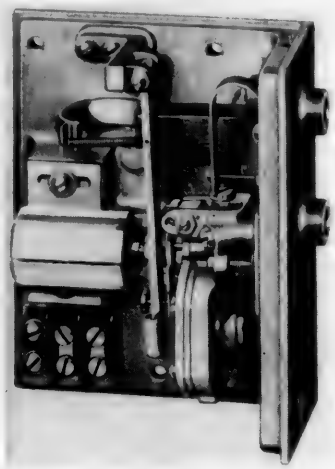
Named the Western Thermoflow, standard units are 7½ ft wide and 10 ft long, with 3 operating cells each, and the units may be installed singly or in multiples. Each unit provides over 33 sq ft of opening. It is completely weather-tight and rises only 21½ inches above the curb. Dampers, operating on nylon bearings, are optionally manual or motor operated. Fusible links will automatically open the dampers for fire and smoke emergency relief.

More information? Circle Item 52, postcard, last page.

Protects Compressor Motors

Protection for motors of centrifugal refigeration compressors from overload on start-up is provided by Model V-26 load limiting relay available from Johnson Service Co., Milwaukee, Wis. It is designed for pneumatic control systems and may be used with all makes of compressors, the company states.

Relay is a limit device which is connected in the control line to the suction damper operator. It limits the output capacity of the compressor to the full load motor



ampere rating. Most centrifugal compressors, the company explains, have a tendency to deliver more than 100% of their rated capacity after overnight or prolonged shutdown or under certain conditions when the cooling load on the building is greater than the refrigeration capacity. It is during these times of overload risk that serious damage to the motor is prevented through use of a load limiting relay.

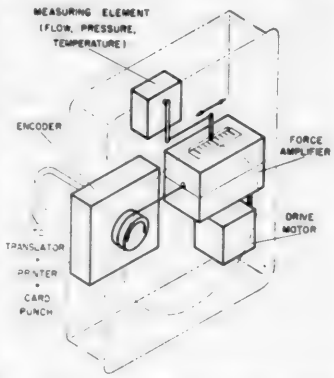
This relay can be adjusted for any current value between 3 and 7 amperes. Since it is used with motors having many times this ampere rating, a current transformer is used to provide a current within these limits. With the proper transformer, the load limiting relay can be used to control compressor motors of any size.

The device consists of an electrical element, plus one of the company's standard pneumatic, direct-acting, proportional action relay, and a feedback element. The latter assures maximum stability and performance. Unit may also be applied to fans, pumps, and electric heating systems.

More information? Circle Item 53, postcard, last page.

Digital Transducers

Series 400 digital transducers, a product of American Meter Co., Inc., Garland, Tex., measure air conditioning and heating power plant variables and provide a digital encoding for remote reading of flow, liquid level, pressure or temperature. They employ the company's completely mechanical force amplifier, actuated directly by standard measuring elements, to position the shaft of a precision encoder (analog to digital converter).



Use of the force amplifier eliminates the need for electronic servos, vacuum tubes, magnetic amplifiers or electronic components, with resultant reduction in initial cost, lower maintenance cost, and an increase in reliability, the company states.

Units are available in vacuum and pressure ranges to 10,000 psi, temperature ranges to 600 deg F, and in mercury or bellows type manometers for liquid level or flow applications. The transducers are conservatively rated with an accuracy of $\pm$ 1.0% of span. Reproducibility is better than $\pm$0.5% of span. Both linear and square root encoders are available. The transducers are housed in standard, all-weather meter cases.

More information? Circle Item 54, postcard, last page.

Adds 12-Inch Pipe to PVC Lines

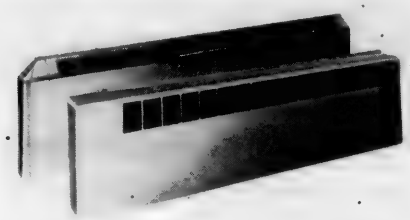
Joseph T. Ryerson & Son, Inc., Chicago, Ill., announces the addition of 12-inch diameter Schedule 40 and Schedule 80 to its line of Ryertex-Omicron PVC rigid, unplasticized plastic pipe. A complete line of fabricated plastic fittings is available for the 12-inch size.

The 12-inch pipe is also furnished in thin wall or Schedule A, it was reported. This is seen being of particular interest to the sheet metal fabricating trade for round duct work in applications in which other materials do not provide the degree of acid fume and corrosion resistance required.

More information? Circle Item 55, postcard, last page.

Continuous Convector

A new-style continuous convector, combining the high heat capacity characteristics of convector design with the advantages of finned tube radiation, is announced by Modine Manufacturing Co., Racine, Wis. Known as the Perma-Trim wall-to-wall convector, this product meets the requirement for a continuous curtain of heated air to blanket large window areas.



Utilizing two or three 1-inch OD tubes (depending on depth of heating element), convector eliminates the need for stacking heating elements within an enclosure to meet high capacity rquirements. As a result, savings in piping substantially reduce installation costs.

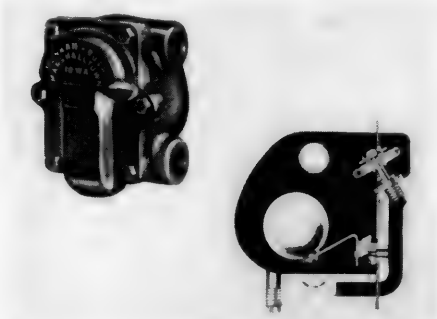
Convector is available in sloping top outlet and face outlet types. A full line of accessories are offered, such as end caps, extension sleeve, and inside and outside corners.

More information? Circle Item 56, postcard, last page.

Redesigned Trap Line

Dunham-Bush, Inc., West Hartford, Conn., announces redesigned float and thermostatic traps, and closed float traps. All working parts of the assemblies in both types can be removed, inspected and repaired without disturbing piping connections.

Low pressure F&T traps Nos. 30 and 40 are applicable to all types of low pressure or sub-atmospheric steam



heating systems and steam process equipment. They are used for pressures up to 15 psi. Number 40 medium and high pressure F&T traps, for operating pressures up to 30, 75, and 125 psi, are applicable to all types of medium and high pressure steam heating systems and steam process equipment. F&T traps Nos. D30 and D40, for operating pressures from 25 inches Hg vacuum to 15 psi, are applicable to the company's Vari-Vac steam heating systems.

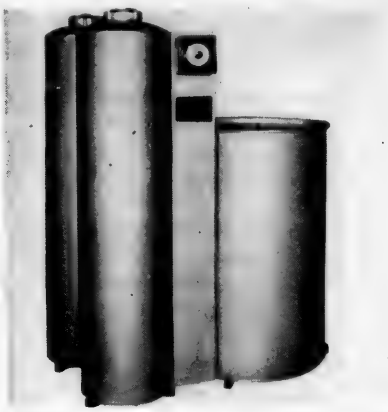
Closed float (drip) traps Nos. 31 and 41, for operating pressures up to 15 psi, are applicable to all types of low pressure or sub-atmospheric steam heating systems. For all types of medium and high pressure heating systems, closed float trap No. 41 is redesigned for operating pressures up to 30, 75, and 125 psi.

More information? Circle Item 57, postcard, last page.

Commercial Water Conditioner

A line of commercial and light industrial water conditioning units, said to provide completely automatic, soft-conditioned water for the same price as manual units, is announced by Water Refining Co., Middletown, Ohio.

The full line of Miracle conditioners includes capacities ranging from 30 to 180 gpm based on 40 psi. Units can



produce 10,800 gph of uninterrupted, completely refined, and softened water. Rust, iron and turbidity are removed as well as hardness.

Conditioners can be easily and inexpensively installed by one man in one day, the manufacturer states. A conditioner can be installed as a close-coupled, compact, unit-in-one, requiring only 10 sq ft of floor space, or remotely, as location and user's needs dictate.

More information? Circle Item 58, postcard, last page.

Changes Round Recording Charts

Availability of a device for automatically changing circular recording charts is announced by Maeder-Squier Co., Dallas, Tex. Called the Automatic Meterman, the method affords the utilization of as many as forty circular charts in a single recorder; disengages the charts, one by one, at virtually any desired time/date frequency; and drops them by gravity into a self-contained storage box.

The changer uses only a minute portion of available clock power. Any number of field or plant recorders can be serviced without manual attention, at the identical moment, thus making it possible to correlate the charts with master meter charts without multiple computations, the company states. The equipment is designed for use on all standard recorders using circular charts of any diameter or thickness.

More information? Circle Item 59, postcard, last page.

Off-Center Lavatory

A lavatory announced by American Standard Plumbing & Heating Division, New York, N. Y., features off-center styling said to offer attractive advantages for commercial as well as residential installations. The bowl, called the New Lucerne, has a left edge curving inward, providing a wide flat surface large enough to hold toiletries and glass-

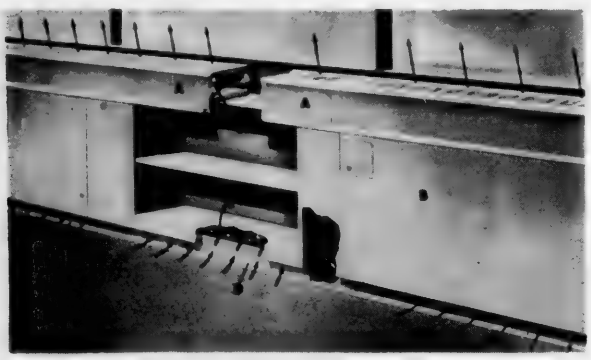
ware. The front and right rims of the fixture slope downward so that water will drain into the bowl.

The entire lavatory is made of vitreous china. Its handy vanity area combined with compact size (20 x 18 or 24 x 20 inches) gives maximum convenience in a small area, the company states. The fixture also has a concealed front overflow, anti-spash rim and integral soap dish. It is installed as a wall-hung unit with or without legs and towel bars and come in white and eight decorator colors.

More information? Circle Item 60, postcard, last page.

Perimeter Air Conditioning

Effective perimeter air conditioning, like perimeter heating, is now available, according to The Trane Co., La Crosse, Wis. The manufacturer's Wall-Line perimeter air conditioning is based on a UniTrane air conditioning unit with pre-assembled ducts which circulate conditioned air along exterior walls. Air conditioning effectiveness is always the same in the room even if interior partitions and walls are moved, because engineers can design a system on a btu/hr/ft and cfm/ft basis that will be maintained for the whole room.



Air flow pattern, illustrated, is as follows:

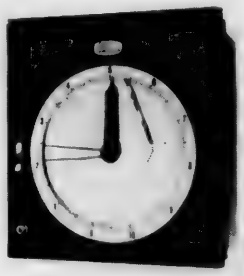
A. Fans push air through ducts which provide conditioned air along complete exterior wall;
B. UniTrane air conditioner circulates chilled or hot water which cools or heats air as it passes over coils;
C. One-half inch insulation resists heat or cool air loss and acts as a sound deadener;
D. After air has circulated in the room, it returns to be heated or cooled through air intakes;
E. When changing partition arrangement, if a partition is placed over the spacer between units, air would recirculate to air conditioner by intake under shelves.

Wall-Line air conditioning can be used in combination with a separate duct supply of conditioned ventilation air, or as an independent air conditioning system.

More information? Circle Item 61, postcard, last page.

Electronic Recorders and Controllers

Electronic indicating recorders and indicating recording controllers, which indicate, record and/or control any process variable convertible to voltage or resistance change, have been developed by Thermo Electric Co., Inc., Saddle Brook, N. J. Applications include conductivity, flow, humidity, pressure, temperature measurement, and many others.



Instrument accuracy is guaranteed to ± 0.25% of scale or 5 microvolts, and is maintained over long periods under adverse conditions. Sensitivity is ± 0.125%, unaffected by line voltage fluctuation, component or amplifier tube change. Either potentiometer or bridge types are used depending upon application. A large number of interchangeable scale ranges is available and can be easily field-installed.

More information? Circle Item 62, postcard, last page.

Jacketing for Pipes

Pyro-Kure is a vapor barrier with fire retardent properties offered by American Sisalkraft Corp., Attleboro, Mass., for use as pipe jacketing and duct insulation facing. The product is composed of foil and kraft paper bonded together with a flame-extinguishing adhesive to make a completely fire-resistant vapor barrier.

When the temperature surrounding this material reaches the combustion stage, gases or vapors are released which tend to smother the flame. The material does not depend for its fire-resistant properties on corrosive salts which can leach out and entirely dissipate its flame-resistance.

Jacketing is also a multi-purpose barrier material that can be used for hot or cold piping. Water or weathering conditions are said to have little or no effect on the flame-extinguishing properties and the adhesive will not melt or run. The reinforcing glass fibers give the barrier unusual strength to assure tear and puncture-free applications, the company states.

More information? Circle Item 63, postcard, last page.

Vertical Turbine Pump

A major innovation in vertical turbine pumps has been announced by Worthington Corp., Harrison, N. J.

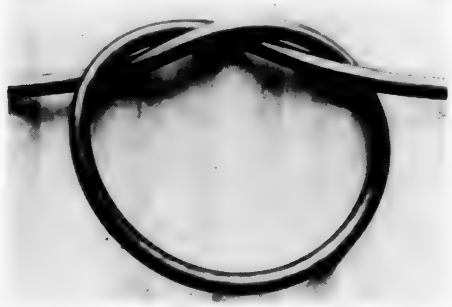
The Ultra High Flow (UHF) pump offers broader coverage to the customer, who can select a custom-made pump from a standard group of alternates. It also ranks approximately 4% above previous efficiency standards maintained by the company. Of primary importance, however, is the fact that the pump maintains high efficiencies over wider operating ranges, thereby assuring the customer of continual and efficient service under any variety of accidental conditions. By increasing the range over which it operates efficiently, the pump also secures for the customer a reduction in power costs.

More information? Circle Item 64, postcard, last page.

Heat Exchanger Tube

A line of welded steel tubing designed specifically for heat exchanger use has been placed on the market by Tubular Products Div., The Babcock & Wilcox Co., New York, N. Y.

Bearing the trade name Lectrosonic, the tubing has been subjected to five years of extensive field tests, and



has proved equal or superior to seamless carbon steel heat exchanger tubing, according to Division spokesmen. Prices for the new line are said to show savings ranging from 10 to 32% over grades of seamless tubing it has been designed to replace.

Tubing production is controlled by a unique quality control system integrated with the fabrication process. The system represents a point of departure from conditions under which conventional electric resistance welded steel tubing is produced, the company states.

More information? Circle Item 65, postcard, last page.

Anti-Vibration Material

An anti-vibration material, called Vibra-Check by its manufacturer, Lowell Industries, Inc., Boston, Mass., is claimed to eliminate 90% of the destructive vibrational tremors and noise caused by machines. It is suitable for machines from 100 lb to 100 tons.

Material is composed of a tough, elastomeric vinyl plastic reinforced with an industrial fiber called monofilament fiber glass. It is fused in layers under heat and high pressure. It is durable, re-usable, and impervious to shock, oil, grease, detergent, and solvent cleaners, the company states.

It isolates vibration by a unique combination of separate layers fused into one product. Its outer layers are of a resiliant low density composition while its central core is a high density hard structure. A vibrational wave meets three different natural frequencies, preventing resonance and isolating the vibration. It conforms to rough and uneven floors.

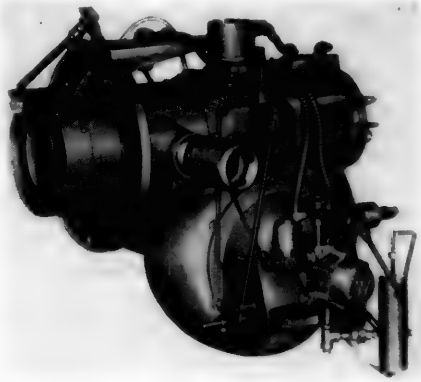
Simple to install, the material, in pads, requires no bolts or adhesives. Its parallel outer surfaces keep machines level, while vacuum suction cups, molded into these surfaces, combine with the natural gripping action of the vinyl to stop creep. According to the manufacturer, reuse of pads of the material is insured by its high breaking strength of 7500 psi, insuring permanence of performance for the life of the machine.

More information? Circle Item 66, postcard, last page.

Burner for Scotch Boilers

An inverted, forced draft, power pressure burner, for application to Scotch Marine boilers, is announced by Ray Burner Co., San Francisco, Calif. Available in oil, gas, and combination gas-oil units, they are fully automatic and rugged, the company states.

Capacities, in appropriate sizes, range from 7 to 30



gph, or gas capacity of 1,000,000 to 4,200,000 Btu per hr.

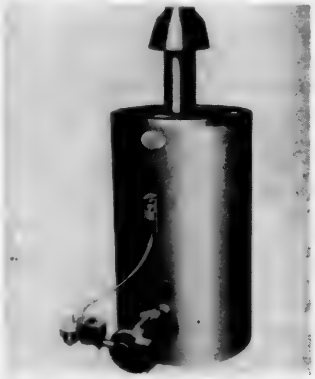
All incorporate the latest types of electronic safety and operating controls. Low-fire start on oil and combination units utilizes the company Modufire system in conjunction with variable flow nozzles. This system is standard on larger sizes and optional at extra cost on smaller units. Efficient high-low fire operation is available with the addition of an extra limit control. Full modulation is standard on larger sizes of gas burners and optional on smaller units.

The high speed forced draft fan furnishes all air necessary for combustion against positive combustion chamber pressures. No stacks or induced draft fans are necessary.

More information? Circle Item 67, postcard, last page.

Gas-Fired Commercial Heater

A direct, gas-fired commercial water heater line, Series DG, is offered by Portmar Water Heater Co., Inc., Brooklyn, N.Y. Designed for volume water heating, these heaters automatically supply large quantities of rust-free hot water for commercial and industrial use.



Galvanized both inside and outside to assure corrosion-free sanitary water, each heater is also equipped with an anode rod for added protection against corrosion. The units can be connected to a storage tank for forced or gravity circulation, thus permitting large storage reserves.

For high volume recovery, in large installations, two or more heaters can be hooked up in tandem. As a direct-fired water heater, the units operate as self-contained instantaneous water heaters. They also operate as a straight recovery heater, recommended with storage tank and circulating pump.

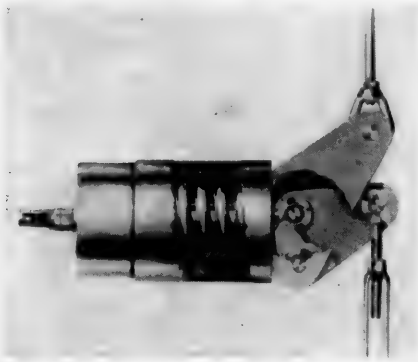
As a recovery booster heater, units supply both 180-deg F water for sterilization and 140-deg water for general use. Four sizes are available: 135, 187, 235 and 300 gph at 100-deg rise. Small and compact, they are completely packaged, ready for immediate installation.

More information? Circle Item 68, postcard, last page.

Constant Support Pipe Hangers

Fee & Mason Manufacturing Co., Inc., Manasquan, N. J., announces the addition of Counterpoise constant support hangers to its lines of pipe suspension equipment.

These hangers are designed to provide constant load-supporting capacity for piping systems subject to expansion and contraction due to temperature changes. Basically spring-actuated counterbalances, they produce a constant supporting effect on loads which travel in vertical directions, and are applicable to piping system movement requiring flexible support.



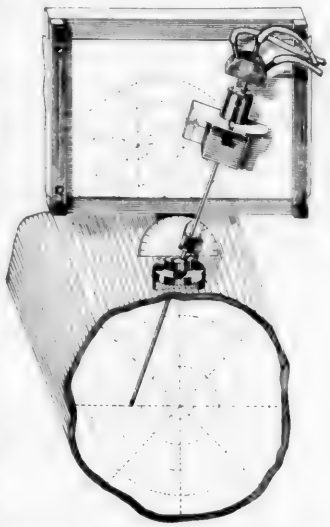
All main load-carrying parts in the new hangers are located at one end of the structure, thus simplifying the design of the loaded parts and permitting installation of the hanger in congested locations. The over-hanging spring assembly can also be revolved at any angle about the load and support rods, providing additional installation flexibility.

The company is offering the hangers in four basic types, each available in a wide variety of sizes: single and double suspension models; a vertical model, where space limitations make it difficult to use hangers with the spring assembly in the horizontal position; and a junior model, compactly designed and light in weight, for auxiliary and intermediate service piping.

More information? Circle Item 69, postcard, last page.

Area Traverse Unit

Manually operated and remote controlled area traverse units are offered by United Sensor & Control Corp., Glastonbury, Conn. With these units detailed velocity, pressure, direction, and temperature measurements can be obtained at any point on a given cross section of a flow duct or other piece of fluid flow machinery, the company states.



The units can utilize different types of primary probes for measuring total pressure alone or total pressure, static pressure, pitch angle, yaw angle, and total temperature. They can be used conveniently to determine total flow or energy at a given fluid stream cross section by integrating the areas inside the contour lines. Direct measurements of efficiency of turbines, blowers, and compressors, can be made. The thrust of jets can be measured directly. The drag of wind tunnel models can be determined by this method. Flow angles at the discharge of turbine or compressor stages can also be determined quickly and conveniently.

The manual type illustrated uses a single access hole at the cross section, a ball and socket pressure joint, and a plotting board mounted perpendicular to the flow direction and parallel to the cross section to be measured. The sensing end of the probe has the pressure or temperature sensing element and the outer end is attached to a positioning block which can be moved freely on the plotting board and is held in any position by magnetic attraction. This block has a protractor for measuring stem rotation and a transparent index plate with a hole for making points with a pencil.

More information? Circle Item 70, postcard, last page.

Welds Aluminum Pipe

An automatic, pipe welding machine, that welds aluminum pipe faster, better and less expensively than ever before possible, was announced by Aluminum Company of America, Pittsburgh, Pa.

Designed and developed by the company, the welder is said to be the first such machine capable of producing sound welds with full penetration, without the use of back-up rings. This gain in welding technique, plus high welding speed (the unit completes a pass on 4-inch pipe in 11 sec) will further narrow the price gap between aluminum and steel pipelines, the company states.

The automatic welder can process all tubular products with outside diameters of from 4 to 11 inches. For versatility, the head of the new unit can be positioned through a wide range of welding angles. It also can be set to oscillate, automatically moving back and forth across weld width to insure complete filling.

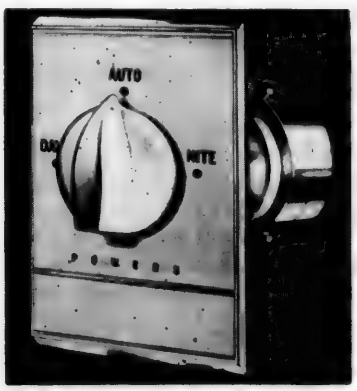
To use the automatic welder, the operator first positions pipe, which then is gripped firmly by mechanically operated clamps. Final positioning and aligning also is done mechanically. By touching a button on the control panel, the operator rotates the head into position and lowers the welding wire. Pressing the start button begins the actual welding.

More information? Circle Item 71, postcard, last page.

Redesigned Selector Switch

An easy-operating remote selector switch to direct or stop the flow of compressed air to pneumatic motors and valves was announced by The Powers Regulator Co., Skokie, Ill., maker of automatic temperature controls.

The switch is 10% smaller than earlier models, and is newly designed to match the company's positioning switch announced earlier this year. By replacing leather with Teflon plastic for the disc in the switch body, friction



has been reduced and the selector knob is easier to turn, the company states. Air leakage is also reduced by the Teflon disc.

The selector switch can be used to divert the control of an air-operated system from one instrument to another, to control a system of valves, dampers, or pneumatic electrical equipment with a positive action, and to change system air supply pressures.

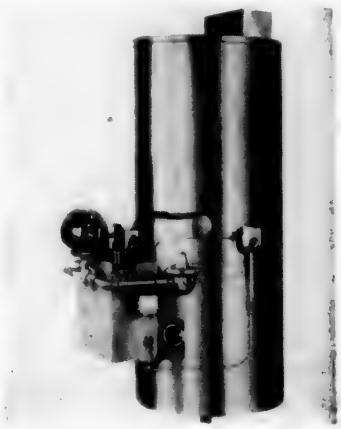
For central panel mounting, the switch needs only 2⅜ x 3⅜ inches of space. Overall depth is 3¼ inches. The switch can be either flush or surface mounted.

Two, three, or four port arrangements can be made on the same body. Eight standard dial styles and three standard nomenclature plates are available. Standard finish is grey with black letters protected by a transparent cover. Air capacity is 580 cubic inches per minute.

More information? Circle Item 72, postcard, last page.

Vertical Water Heaters

V-CD immersion water heaters are vertical floor-space saving versions of the controlled draft water heaters, manufactured by Sellers Engineering Co., Chicago, Ill. These immersion firing heaters are said to be simple, compact and fully automatic. Solid copper firing tubes are featured.



Vertical models have been returned to the company's line because of the vastly increased demand for a package-type, large volume heater requiring a minimum of floor space, the company says. The armed forces have specified them.

Two types are available: the standard model, which is direct-fired and provided with solid copper tubes; and the indirect model, equipped with a copper tube heat exchanger and steel firing tubes recommended for heating zeolite softened and the more aggressive soft waters.

More information? Circle Item 73, postcard, last page.

Plastic-Coated-Hair Filter

Development of a permanent, dry-type, electrostatic air filter for low velocities (300-600 fpm) is announced by Peden Equipment Co., Houston, Tex.

Known by the trade name Filtr-Aire, and made of Saran-coated natural hair, these filters are fire resistant and can be readily cleaned by water washing. The controlled plastic coatings also produce progressive filter loadings which result in longer effective filtration without substantial reduction of air-flow, the company says. Since the filter is a dry type, there is no viscous substance to gei on either equipment or personnel.

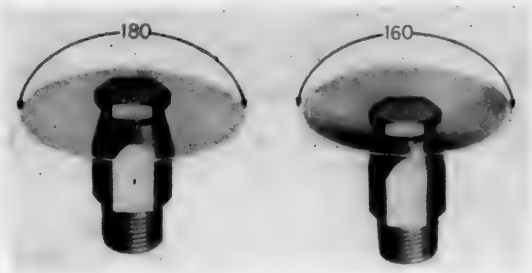
Electrostatic filters remove dust, smoke, soot, bacteria, odors, pollen and are designed to cope effectively with lint problems. A strong, one-piece aluminum frame with expanded copper-bearing galvanized metal lath holds the filter media firmly in place. A full range of standard sizes is manufactured in ½-, 1-, and 2-inch thicknesses. Also, any special sizes can be fabricated upon request.

More information? Circle Item 74, postcard, last page.

Industrial Spray Nozzle

An extra-wide angle, circular-spray nozzle for industrial applications is announced by Wm. Steinen Mfg. Co., Newark, N. J. Called the Span-Jet nozzle, it was developed for spraying or washing the inside of tubular units.

Unit is made in two styles to provide either a 180°



flat, circular spray pattern or a 160° hollow-cone spray pattern. The nozzles are made in capacities from .75 to 10 gpm at 40 psi pressure. The standard nozzles are made with a male connection to fit pipe sizes of ⅛, ¼, and ⅜ inches and are available in brass, 303 stainless steel or special materials as required.

Besides being useful for spraying or washing the inside of tubular units, the nozzle has applications in air washers, roof cooling, various chemical processes and many other uses where extraordinary wide-angle sprays are required.

More information? Circle Item 75, postcard, last page.

Schoolroom Heating and Ventilating

A new product line of schoolroom heating, ventilating and cooling systems is announced by Janitrol Heating and Air Conditioning Div., Surface Combustion Corp., Columbus, Ohio. The system is a self-contained, individual room heating and ventilating system, and includes perimeter-type, draft-free air distribution. Summer cooling is available as an option. It is reported that the system in-

stalls very economically, with up to 60% savings over large central systems.

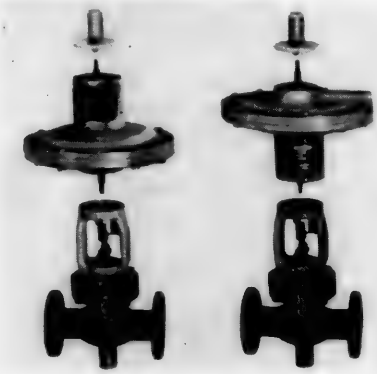
System utilizes a counter-flow gas-fired conditioner, which is enclosed in a floor-to-ceiling metal cabinet, and includes wall duct sections that are attached to exposed walls and discharge the conditioned air in a vertical pattern. The duct sections, which hang from the wall, may provide extra storage space by including matching shelf sections.

The modular sections of the system permit unusual flexibility in installation for new schools, additions to existing structures, or for modernization of older school rooms, the company reports.

More information? Circle Item 76, postcard, last page.

Valve Operator Inverts

Added to the line of Bantam control valves designed and manufactured by George W. Dahl Co., Inc., Bristol, R. I., is the versatile Series 540 which features one operator. By simply inverting this operator, air can be utilized to either open or close the valve.



Valves have Teflon packing and gaskets. Standard body pressure rating is 300 psi. Body temperature rating is 450 deg F with standard bonnet, while operator temperature rating is 180 deg maximum. Flow coefficient ranges from 0.002 to 13.2.

Operator is cast aluminum and utilizes a 3- to 15-psi air signal on a molded diaphragm. It has low hysteresis and linear response.

More information? Circle Item 77, postcard, last page.

Insulated Flange Joints

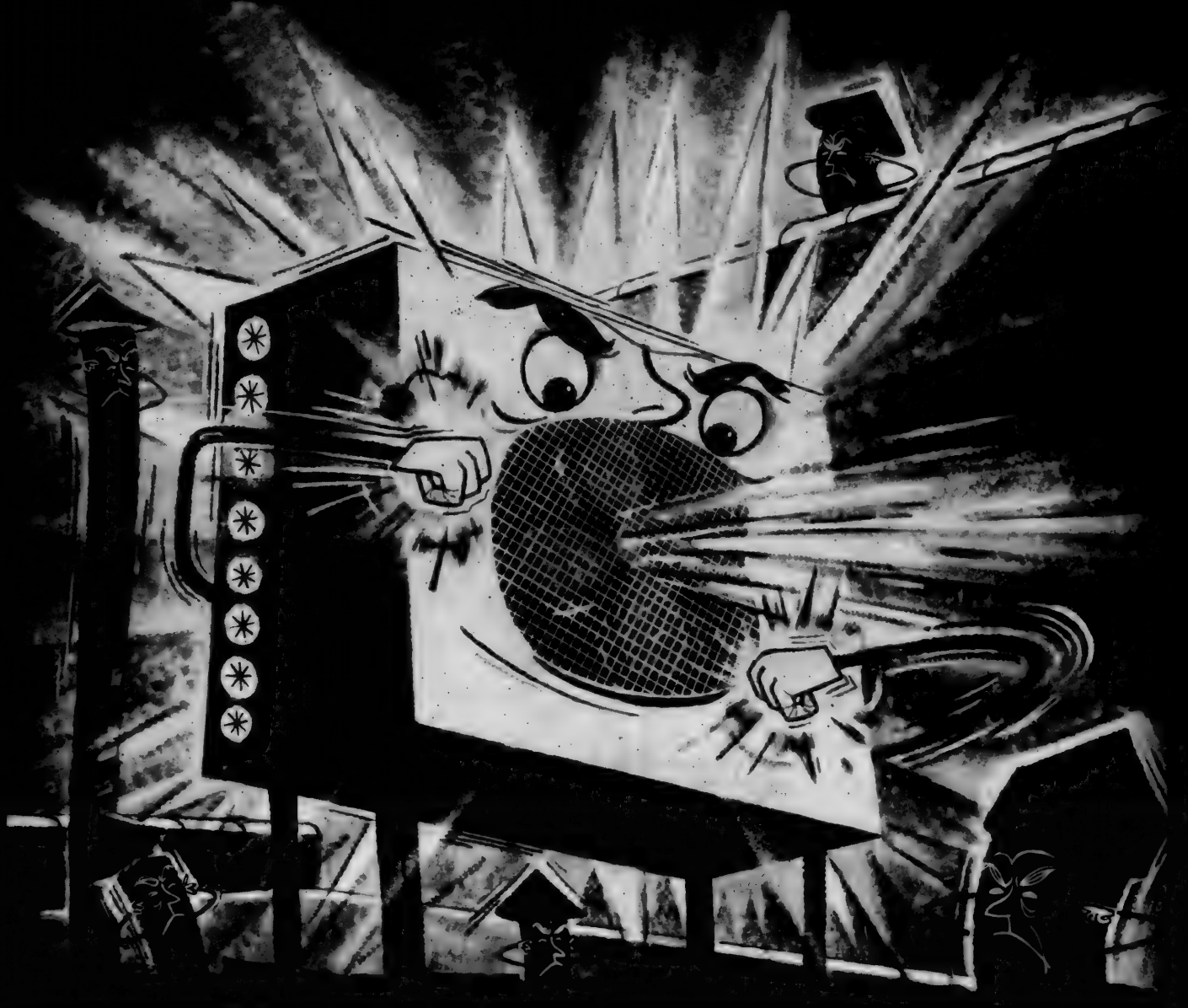
Availability of pre-assembled insulated flange joints in all pipe line sizes is announced by Tube Turns Div., Chemetron Corp., Louisville, Ky.

Assembly in the shop avoids difficulties in field assembly of insulated flanges used to check electrolytic corrosion in underground piping, the company said; in addition, it makes possible such extras as certification for maximum operating pressure and guarantee of zero electrical conductivity. Dielectric (non-conducting) insulating gaskets, sleeves and washers eliminate any metal-to-metal contact that would permit flow of either induced or self-generated electric current.

In many instances, especially in 24 to 42-inch sizes, cost savings of 20 to 25% over American Standards flanges are feasible with insulated joints specially designed, manufactured and pre-assembled for particular service conditions, according to ASA principles, the company reports.

More information? Circle Item 78, postcard, last page.

(Continued on page 112)



BEFORE YOU BUY, THINK:

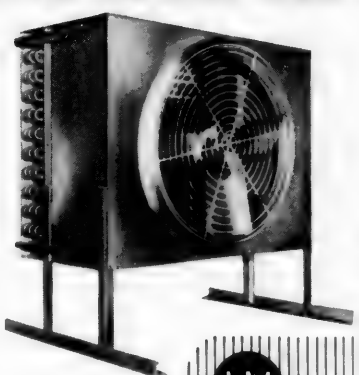
Will your air-cooled condensers sound like thunder?

Not even from close up if they're by Halstead & Mitchell

Fan noise, vibration and rattling have been engineered out of H&M air-cooled condensers. Deep pitch fans are run at slow speeds. Casings are rugged; won't loosen with use.

H&M condensers are completely dependable. The large coil and exclusive Turbu-Flo fins improve heat transfer by up to 15%. Fins are spaced widely to avoid clogging by dirt and other air-borne particles.

Winter operation is easy, too, with H&M's special modulating valve. Halstead & Mitchell air-cooled condensers are available in propeller fan or blower models. Multiple circuiting at no extra cost. Ask your local distributor for complete information, or write to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.



H&M AIR-COOLED CONDENSER

HM

Halstead & Mitchell

Water-Cooled Condensers · Cooling Towers · Air-Cooled Condensers · Finned Coil Products

MEASURE

ACTUAL
AIR DELIVERY

with

Alnor®

VELOMETER

A simple, direct reading on the Alnor Velometer gives you instant measurement of actual air delivery in any distribution system. This fast, precise method eliminates the time and money wasted in trial-and-error balancing...the profit-eating call-backs so often necessary with other less precise measurements.

The Velometer is the only instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low... compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

First Choice of Industry

Take the recommendation of every major manufacturer of air diffusers and leading contractors—get an Alnor Velometer. You'll save time and money on the next installation you balance.

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PRECISION INSTRUMENTS
FOR EVERY INDUSTRY

Illinois Testing Laboratories, Inc.
Room 514, 420 N. LaSalle St.
Chicago 10, Ill.

Please send Velometer Bulletin 2448-G.

Name.....

Company.....

Address.....

City.....Zone.....State.....

(Continued from page 110)

Electric Baseboard

A line of baseboard electric heating with a sealed element is available from Westinghouse Electric Corp., Pittsburgh, Pa., in 2-, 4-, or 6-ft sections. Heating capacity is 250 watts per linear foot.

By using a three-way airflow design, the surface temperature of the baseboard sections is kept low enough to touch. Room temperature can be maintained within 2 deg F of any desired temperature (from 55 to 85

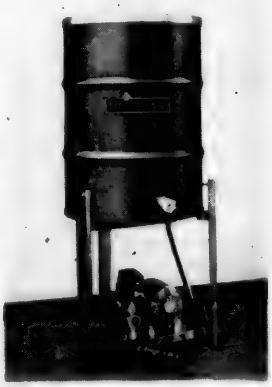
deg F) with a thermostat control section. Also included in the line are electrical outlet, corner, end and blank sections. All sections are seven inches high by two and five-eighths inches deep, and they can easily be joined together to form a continuous unit.

This baseboard electric heating can be installed in new construction or in existing rooms—either surface mounted or recessed. In addition to a conventional one-year warranty of workmanship and materials, the company's Corox heating element is guaranteed for ten years against burnout.

More information? Circle Item 79, postcard, last page.

Pump-Tank Chemical Feed System

A compact and low cost Pump-Tank Combo, utilizing Proportioneers Model 1106 Adjust-O-Feeder for accurate and efficient general chemical feeding and for boiler water treatment, is announced by B-I-F Industries, Inc., Providence, R. I.

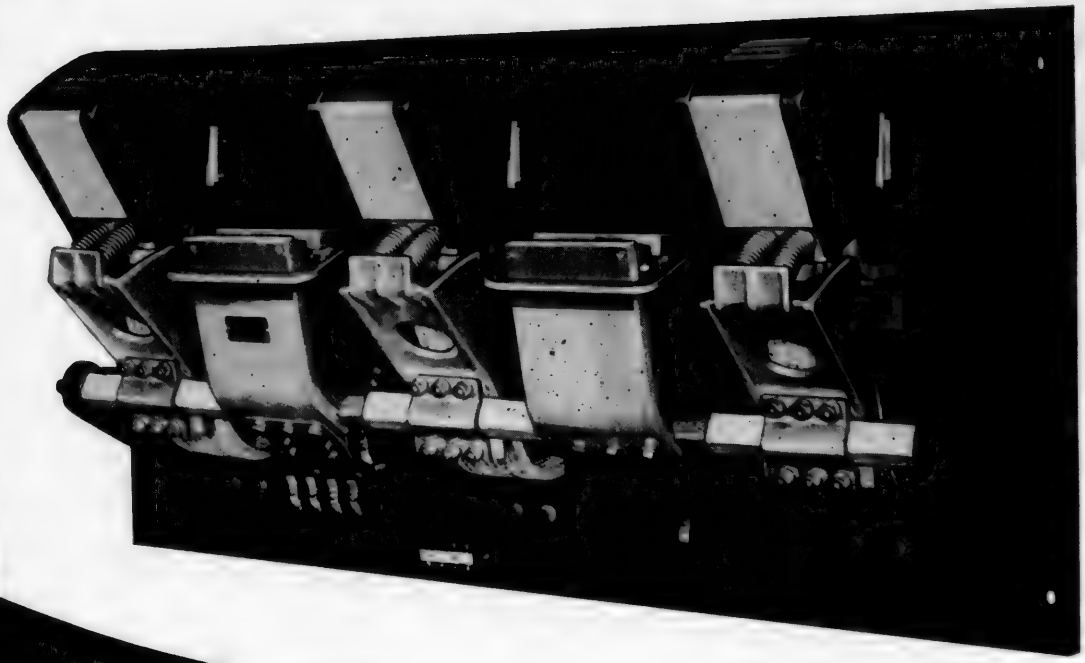


Combination is designed to use a minimum of space. The 55-gal steel support drum, containing the molded polyethylene tank for the chemicals, is mounted atop a three-legged angle iron frame. The pump, with its strainer, fittings and hoses, is mounted on cross members of the frame. The entire unit stands only 53 inches high. The tank, fittings and tubing are all made of corrosion-resistant materials suitable for handling most industrial chemicals.

Pumping capacity is up to 50 gph for discharge pressures up to 1100 psi.

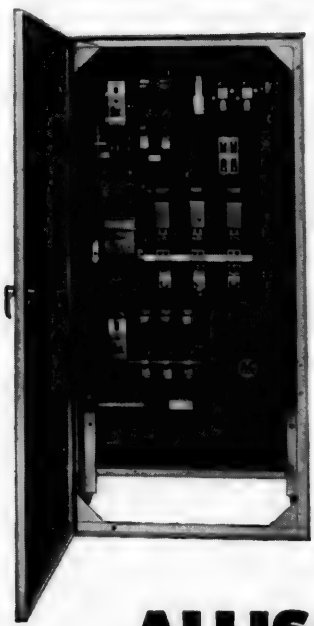
More information? Circle Item 80, postcard, last page.

(Continued on page 114)



Rugged* Simplicity

in air-conditioning motor starters



Simple, durable contactors assure continuous service

ONE look reveals the clean, balanced design of Allis-Chalmers contactors. Fewer parts eliminate many potentially troublesome areas — mean less wear. Simple, solid construction and high interrupting capacity are positive assurance of reliability.

For continuous air-conditioning service during peak summer loads, be sure to get the proven dependability of Allis-Chalmers contactors. It is these contactors that make all 600 volt Allis-Chalmers Size 4-8 reduced voltage starters the reliable performers they are.

Call your nearby A-C sales office or distributor for complete information, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

*7th meaning, Webster's New Collegiate Dictionary, Second Edition.

ALLIS-CHALMERS

A-5783

Quickdraft... THE WORLD'S SAFEST

POWER DRAFT UNIT FOR INDUSTRIAL, RESIDENTIAL AND INSTITUTIONAL EXHAUSTING

Increases heating and combustion efficiency!

Provides air power for bulk materials handling!

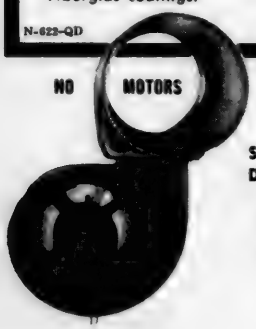
Exhausts corrosive gases and abrasives!

Quickdraft provides industry, commerce, institutions and homebuilders *power draft* engineered for economical and efficient combustion regardless of building or atmospheric conditions. Models suitable for every heating or incinerator application . . . eliminate pulsating or chattering, puffing, smoking and sooting. Reduce building costs, no tall, unsightly stacks required. Quickdraft also provides industry with ¼ inch to 60 inches W.G. static pressure for exhausting corrosive gases, abrasives and paint spray. Heavy-duty, high-pressure models, 6 inches to 30 inches diameter, are available for moving bulk materials or anything that can be moved by air. Because there are no motors, fans or bearings in exhaust line, only Quickdraft avoids costly clogging, corrosion of moving parts or fan failure.

IMPORTANT NOTICE

For withstanding corrosive gases, all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P.V.C.) and with plastic and Fiberglas coatings.

N-623-QD



NO MOTORS FANS OR BEARINGS IN EXHAUST LINE

Send for QUICKDRAFT ENGINEERING DATA on your application . . . now.

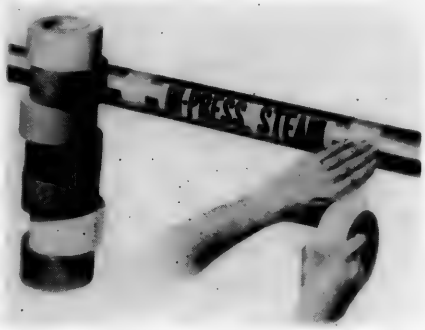
Quickdraft CORPORATION

P.O. Box 87— O Canton 1, Ohio

(Continued from page 112)

Tape Color-Codes Pipe Lines

Pressure-sensitive tape in colors to meet ASA Pipe Coding Standards A-13 is offered by W. H. Brady Co., Milwaukee, Wis. Tape is designed to meet maintenance standards in industrial plants and military installations which require legend marking plus color banding of pipe lines. The self-sticking tape withstands temperatures up to 300 deg F.



Brady pipe banding tape is stocked in the following colors: Yellow for dangerous materials; Blue for protective materials; Red for fire protection equipment; Green for safe materials; Aluminum for steam lines; Orange for electrical conduit, and Standard White. The tape comes in 2¼-inch by 30-yard rolls.

Tape is best used in combination with the company's Perma-Code pipe markers. This combination identifies pipe contents on the underside of the pipe with both color and legend, and completely around the pipe with a color that identifies classification of contents.

More information? Circle Item 81, postcard, last page.

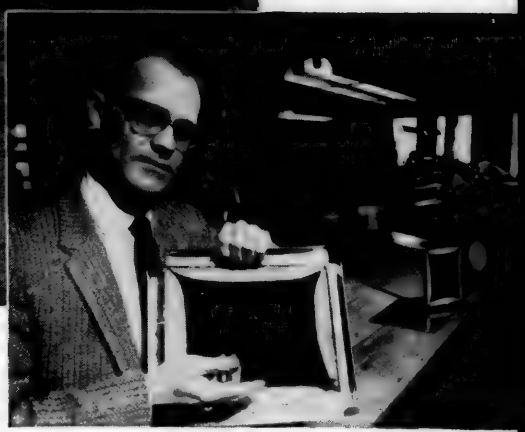
Dual-Service Lab Fixture

A dual-service fixture for educational, research, and industrial laboratories is the Model BL-4150 Vari-Outlet turret with hose cocks, manufactured by T & S Brass and Bronze Works, Inc., Westbury, Long Island, N. Y., as part of its Lab-Flo line. This flexible turret unit, with ⅜-inch

IPS female inlets, accommodates two services from one fitting source. Arrangement may be two-way at 90 or 180 degrees, or four-way, if desired. Color-coded index buttons identify respective services for Gas and Air, Gas and Vacuum, Air and Vacuum, etc.

More information? Circle Item 82, postcard, last page.

(Continued on page 116)



Pittsburgh Superfine is quickly cut to correct size with a knife. Cut sections are then bonded to duct with adhesive. Extra adhesive is applied to edges of insulation to adhere them to edges of metal.

"We used one-inch, 1½-lb. density Pittsburgh Superfine Fiber Glass Insulation with a Neoprene coating to line all ducts," says Mr. George P. Fenton. "Superfine is flexible, adaptable and easy to handle."

At Greater Pittsburgh Airport's New Extension— Pittsburgh Superfine Insulates Air Conditioning Duct Work

"When our company installed the sheet metal ducts for the two air conditioning systems at Greater Pittsburgh Airport's new East Dock, we used over 7,000 sq. ft. of Pittsburgh Superfine Fiber Glass Insulation as the acoustical and thermal lining for the ducts," reports Mr. George P. Fenton, General Manager, McIlroy Sheet Metal Engineers and Fabricators, Pittsburgh, Pennsylvania.

Why Pittsburgh Superfine was specified

"This job called for an insulation that could withstand air velocities, would have proven erosion resistance, would provide good acoustical properties at minimum cost, and would insure resistance against temperature differential. Pittsburgh Superfine met all these requirements easily."

Easy to work with on the job

"We've used Pittsburgh Superfine often, and know from experience that it's flexible, adaptable, easy to handle and easy to cut. It's especially adaptable for use in irregularly curved ducts. There was not a single installation problem on the airport job that we could not handle with Superfine," concluded Mr. Fenton.

Pittsburgh Superfine Fiber Glass can help you, too!

It's rot proof, fire-resistant . . . and it's the finest insulation against heat, cold or noise you can get! Available in a variety of facings to meet your needs. For complete information, write to *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.*

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

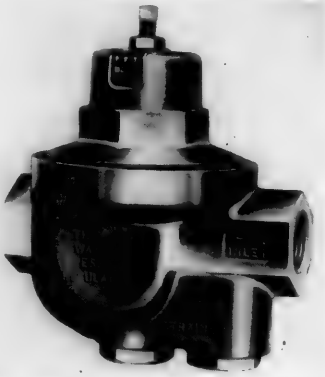
FIBER PG GLASS PITTSBURGH PLATE GLASS COMPANY

(Continued from page 114)

Pressure Regulating Valves

Redesign of its line of pressure regulating valves is announced by H. A. Thrush & Co., Peru, Ind.

Valves can be used on initial pressures up to 250 lb and they can deliver up to 100 lb. These quality valves feature ease of maintenance: The special composition seat



and built-in Monel strainer can be removed and cleaned or replaced without removing the valve from the line or changing its pressure setting.

Pressure regulating valves protect plumbing fixtures, reduce water hammer, improve dishwashing machine operation by controlling rinse spray pressure and control high or fluctuating inlet pressures automatically to give constant delivery pressure. Low pressure regulating valves or automatic filling valves are equipped with built-in checks to prevent the loss of water should the initial pressure drop.

The valves in this line are operated by a heat-resistant, composition diaphragm and all working parts are brass. They come in ½, ¾ and 1-inch sizes and may be either cast iron or bronze.

More information? Circle Item 83, postcard, last page.

Frequency Converting Systems

Packaged frequency converting systems have been added to the motor-generator line of Kato Engineering Co., Mankato, Minn. Compact sheet metal housing contains all necessary switchgear for both motor and generator, with the converter mounted on a structural steel base as an integral part of the base of the cubical.

The 60 to 400 cycle frequency converter has an output of 30 kw when operated at 3428 rpm. The generator is rated 30 kva, unity power factor, 3-phase, 120 volts delta-connected.

Motor-generator set is of single shaft, common frame, two bearing construction. The unit comes complete and ready for operation with both generator output and motor input lead wires supplied and marked.

More information? Circle Item 84, postcard, last page.

(Concluded on page 120)

YOUR IDEAS WORK BETTER WHEN YOU WORK WITH HONEYWELL

THE FOLLOWING pages bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

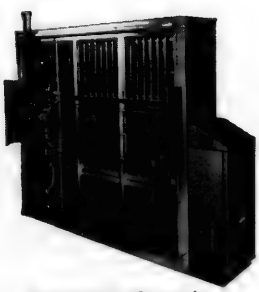
For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 sales offices throughout the country. Each is staffed with control specialists to assist you in writing specifications and preparing control layouts.

NOW! FLUTTER-JET WASHING
Another first for Honeywell's
ELECTRONIC AIR CLEANER

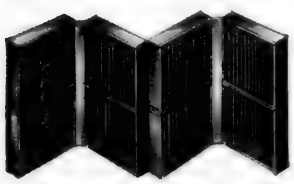
Actual unretouched strobelight photograph taken at 1/2,000 second.

Never before such a quick, efficient way to wash electronic air cleaners! Honeywell's new flutter jet washer literally *blasts* water throughout the air cleaner, with a fluttering, sweeping action that flushes away accumulated dirt quickly—cleans every part thoroughly. The new flutter jet nozzle never clogs.

Honeywell's Electronic Air Cleaner
Removes 90% or more of all airborne dirt



Honeywell's Electronic Air Cleaner



Honeywell's Activated Charcoal Filter

You can now select from three types of cells: (1) *Hi Velocity*—for 90% or more dirt removal or where space is limited. (2) *Standard*—for normal conditions, provides high efficiency dirt removal and high dirt capacity. (3) *Hi Load* for handling high dirt concentration.

With these 3 different cell capacities, you can have complete freedom in designing your plenums. Just select the cell type and number of cells that will give you the air cleaning capacity you need in the plenum space available. No longer is it necessary to design your plenum to fit the air cleaner.

Remove Odors, Too

For the ultimate in air cleaning, team up Honeywell's Electronic Air Cleaner with the Activated Charcoal Filter—for removal of *all odors and gases*, too. Only Honeywell offers this *exclusive* combination.

For more information about Honeywell air cleaning, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department HV-8-107, Minneapolis 8, Minn.

Honeywell

First in Control

EXAMPLE: From Honeywell's exact pneumatic v

Single seated pneumatic valve

3-way pneumatic valve

This new line of Honeywell Pneumatic valves gives you superior performance characteristics, sharply upgraded ratings

BECAUSE valves supply the final control for over 90% of all temperature control systems, Honeywell has concentrated increasingly on the engineering of more dependable valves.

. This newest line of Honeywell Pneumatic valves comes from four years of research, design and testing—an intensive development program which has produced a series of valves that set new industry standards for reliability and performance.

New valves provide wider limits of rangeability! These new valves provide accurate control of flow from the fully open position to the critical, hard-to-control light load situation. This has been made possible by these advanced design concepts:

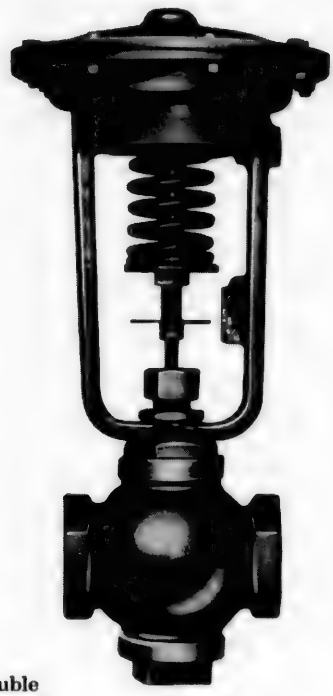
- A contoured plug or "characterized" V-port, precision made, provides a gradually-increasing rate of flow, giving far more sensitive fluid control.
- "Positive positioning"—made possible by the check-and-balance principle of the unique Honeywell Gradutrol relay. It assures accurate stem positioning regardless of changes in pressure differential.

They're designed for minimum maintenance. Precision design eliminates friction. Critical parts are made of durable, wear-resistant materials—Neoprene motor diaphragm, stainless steel stem, teflon packing, composition disc.

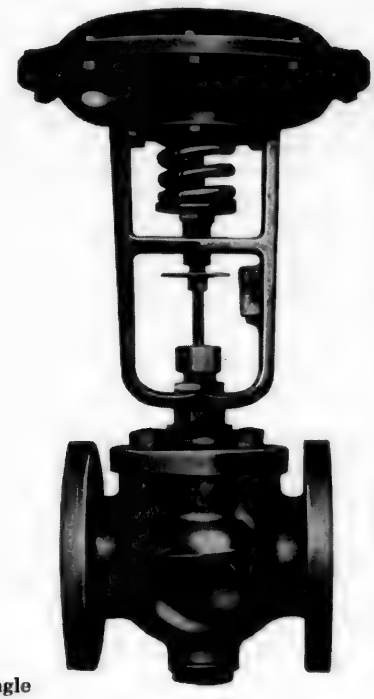
If repair is ever required, valve design permits fast, convenient parts replacement. For example, in most models the yoke can be removed to replace valve stem, packing, disc or seat without removing the valve from the line.

Honeywell Pneumatic valves are available in a wide variety of types and sizes—one to meet your exact requirement. Your Honeywell control specialist will supply you with complete specifications for the entire line, supply you with valuable assistance in choosing the valve to order. Call him at your local Honeywell office or write Honeywell, Dept. HV-8-107, Minneapolis 8, Minnesota.

complete line...the
valve to match your application



Series 400 double seated diaphragm valve



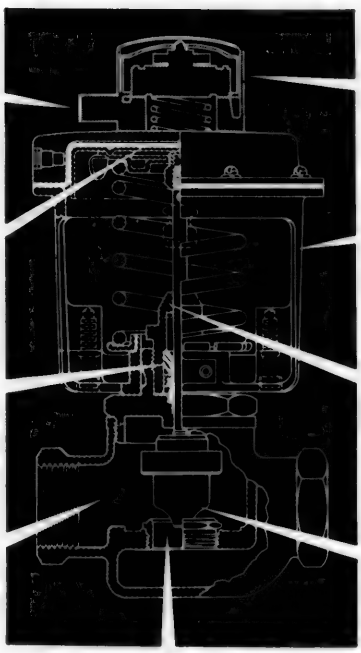
Series 400 single seated diaphragm valve

Air Connection Rotates 360° with Actuator.

Replaceable, Sensitive Roll Type Diaphragm.

Teflon Packings are Spring-Loaded and Self-Adjusting.

Large Flow Chamber Permits Higher Capacity.



Gradutrol Relay Insures Positive Positioning of Valve Stem.

2-Piece Yoke Simplifies Maintenance

Sliding Stem Retainer for Simpler Installation

Contoured Plug Insures Equal Percentage Flow at All Load Levels.

Seat Can Be Replaced without Removing Valve From Line.

Symmons TUB-SHOWER

COMBINATION VALVE

simplified design provides full flow & temperature control

with Only ONE Moving Part

- A single handle selects the desired temperature and delivers the flow to the tub spout.
- Attached to the handle is a single spindle which controls volume and temperature. It carries both washers.
- A simple push-button unit diverts the tempered water to the Shower Head when desired, by simply pressing the Diverter button.
- Symmons Tub Shower is competitively priced, accurately machined and ruggedly constructed.
- Symmons is the simplest, most modern, most trouble-free mixing valve available today. It is designed for lifetime service.

See SWEET'S ARCHITECTURAL FILE, DOMESTIC ENGINEERING CATALOG or write us direct for further information

Symmons ENGINEERING COMPANY

Dept. 1-C, 448 C STREET, BOSTON 10, MASSACHUSETTS

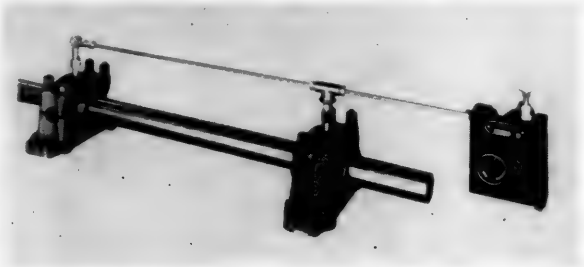
Write today for Tub-Shower bulletin.

(Concluded from page 118)

Centralized Lubrication System

A centralized lubrication system which oils all bearings simultaneously in a single operation is now standard, at no extra cost, on all its air conditioning and refrigeration equipment with sleeve-type bearings, announces Marlo Coil Co., St. Louis, Mo.

In the forced feed system, the single pull of a plunger delivers a measured amount of lubricant from a central

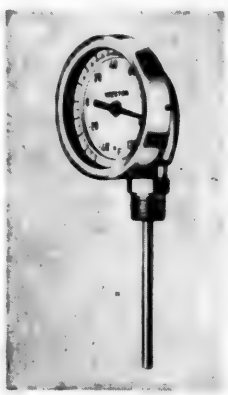


reservoir to all bearings at a pressure of 30 psi. On Marlo units with two or three bearings, a system with 60-cc lubricant reservoir is used—enough for 60 "shots." On units with four or five bearings, a 150-cc system is used, providing 75 "shots" without refilling. Because the system is sealed and lubricant is filtered before it enters the distribution lines, no foreign matter can reach the bearings. The system is said to reduce and simplify maintenance, and eliminate guesswork and human error in lubrication.

More information? Circle Item 85, postcard, last page.

New Bimetallic Thermometers

Easy-to-read bimetallic thermometers—calibrated for accuracy of plus or minus one percent of range over entire scale—are introduced by Weston Instrument Div., Daystrom, Inc., Newark, N. J.



Model 4000 thermometer series, back connected (angle) and bottom connected (straight form), features all stainless steel construction, including the welds.

Newly-developed composition gaskets provide maximum protection against "breathing" and leakage; heavy glass windows offer high resistance to breakage; removable bezels (covers) make field replacement easy if glasses are damaged; and redesigned in-line pointer and scale eliminate parallax errors, making correct readings possible at positions other than eye level.

The thermometers are equipped with an external mechanism for easy re-calibration of the instrument without removing the bezel.

More information? Circle Item 86, postcard, last page.

Facts to help you evaluate various airturning devices

Design . . . cost . . . installation . . . performance

Recent studies in the field and in Barber-Colman air distribution laboratories have shed some highly revealing light on the subject of guiding air around corners in duct systems. The facts uncovered should prove very useful to contractors and engineers concerned with both costs and system performance.

The studies involved long-radius elbows without vanes, square elbows with contractor-fabricated turning vanes, and square elbows with Barber-Colman Airturns.

Airturns vs. Long-Radius Elbows

Where space permits their use, long-radius elbows give good performance. With a minimum radius of one and a half times the duct width, pressure loss can be held within about 20% of velocity head.

However, square ducts with Barber-Colman Airturns give identically good performance — and cost less to install.

Performance has been exhaustively established in the laboratory through the use of visual air flow devices, piezometer rings, pitot tubes, and other instruments used by the slide rule boys (who have turned rule-of-thumb air distribution practice into an exact science). No other factory-made units currently available match Airturn performance.

The lower installation cost of square elbows with Airturns has been proved in the field by a number of large contractors who maintain detailed and accurate cost records.

Airturns vs. Contractor-Fabricated Vanes

Recently a contractors' association asked Barber-Colman to compare the performance of Airturns with that of both single- and double-thickness vanes fabricated in contractors' shops. Pressure loss with the Airturns ranged from 14% to 20% of velocity head. Loss with the various contractor-fabricated vanes ranged from 24% to 48% — from nearly two to more than four times as much! Engineering Bulletin EB-46 describing these tests is available to anyone upon request.

Fig. 1 — Barber-Colman Airturns are available in specific sizes . . . or in 48" x 48" slabs which many contractors find it convenient to stock. Exclusive compound radius vanes assure minimum pressure loss. Installation is inexpensive, quick, and easy — Airturns are held in place with sheet metal screws.

While a pressure loss in excess of 20% of velocity head may not always be serious in a single turn, the cumulative effect throughout a system adds up to a real headache and can result in call-backs that chew up profits in a hurry.

With contractor-fabricated vanes pressure losses are an unknown. Conversely, Barber-Colman Airturn pressure loss data gives you the true elbow losses throughout the system.

Cost of Airturns

Airturns are available cut to the sizes required, ready to install . . . or are available in 48" x 48" slabs. The slabs can be cut easily to required size with aviation snips or metalcutting power saws. In either case, the complete unit is quickly and easily installed with sheet metal screws.

Many contractors find it convenient to stock Airturns with 48" bars and with vane lengths to correspond to the height of ducts commonly used.

When initial cost, installation cost, and call-back costs are considered, it is not hard to see that Barber-Colman Airturns are a good buy. Even if system performance and ease of installation were disregarded, the high cost of shop labor appears to give Airturns a comfortable cost advantage over contractor-fabricated vanes.

Literature

If you would like to know more about Airturns or would like to place an order, call your local Barber-Colman air distribution field office or write.

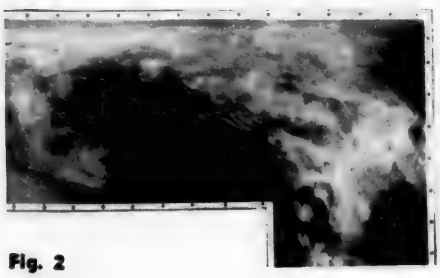


Fig. 2

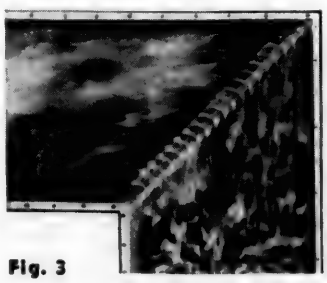


Fig. 3

Air flow studies in Barber-Colman laboratories show that a square duct corner without turning vanes creates pressure losses in the area of 167% of velocity head (Fig. 2).

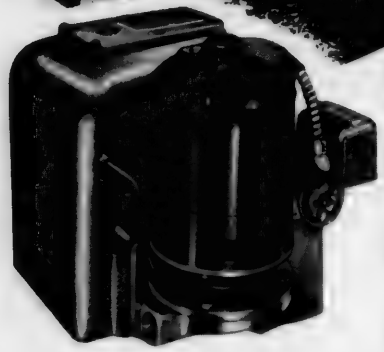
With a Barber-Colman Airturn, pressure loss is but 20% of velocity head — performance otherwise attainable only by use of a space-consuming long-radius elbow (Fig. 3).

BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. T, 1102 Rock Street, Rockford, Illinois

IT'S NEW! IT'S TOPS!
it's the Sterlco 4223-E
LOW PRESSURE
CONDENSATE PUMP



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UNUSUAL CAPACITY
TREMENDOUS PERFORMANCE
ECONOMICAL PRICE

● DESIGNED SPECIFICALLY FOR SMALL INSTALLATIONS . . . yet adequate for jobs up to 3000 sq. ft. EDR.

● ALLOWS ACCURATE ADJUSTMENT . . . Float switch travel can be adjusted for a draw of from .7 to 3 gals. per pumping cycle for close adjustment to boiler requirements.

● SMALLER IN SIZE, YET BIGGER IN USABLE VOLUME . . . a truly believe-it-or-not design. Although the 5 gal. cast iron tank is one of the smallest, it has greater "draw" or usable volume than many pumps with larger tanks.

● LOTS OF EXTRA CAPACITY FOR EMERGENCIES . . . Equipped with the same pump and motor used for the larger capacity ¼ h.p. Sterlco pumps.

● TAKES LESS SPACE THAN ANY OTHER . . . Occupies only 1.6 sq. ft. of floor space. Fits easily into almost any small corner because of rectangular shape and convenient location of motor and switch at front of unit.

● EXCEPTIONALLY QUIET, RUGGED, DEPENDABLE . . . Includes the same high quality features found in Sterlco's heavy duty pumps.

USE THE RIGHT PUMP FOR THE JOB!
The addition of the No. 4223-E makes the Sterlco 4100-4200 Series Condensation Pumps one of the most complete lines of low pressure pumps on the market.

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CONDENSATION AND VACUUM PUMPS

HEATING SPECIALTIES

TEMPERATURE CONTROLS

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

EXHAUST SYSTEM DESIGN

A new (third) edition of Design of Industrial Exhaust Systems, by John L. Alden, has been published after careful review and extensive revision and expansion of a text which has been a standard reference in its field for more than twenty years. The new edition fully covers advances in the variety and quality of devices available to engineers and industrial hygienists. Fog filters, reverse flow filters, venturi scrubbers, and multiple miniature cyclones are some of the more recent items described. Additional material presented in the third edition updates the basic text to account for increasing appreciation of sound engineering principles as revealed in a recent examination of 1700 patents related to dust control devices.

The author, an engineer formerly in industry and currently active as a consultant, has not sacrificed the old-time know-how color of his original classic. Such terms as "rectangular pipes" (for ducts) and "M.A.C. values" (for threshold limits, which incidentally have been revised according to the latest tables) reflect John Alden's many years of close practical association with industrial ventilation. At the same time, an impressive array of formulas, tables, footnotes, and references point up the fact that this is a complete, modern, engineering text.

Subjects covered include: Fluid flow, hoods of all types with their characteristics and specifications for various operations, duct (piping) system design, dust separators with characteristics of various types, pneumatic conveyors, fans, system detail and planning, field measurements and their interpretation.

Two outstanding characteristics of this book are its clarity of presentation and its complete practical applicability. Although it was written by an engineer for engineers, it is also a clear guide to contractors, building owners, hygienists or anyone concerned with the industrial environment, showing laymen and engineers alike how to design, build, or buy an exhaust or air cleaning system. Typical of its practical value are the drawings and detailed specifications for hoods serving a wide variety of industrial situations and the straightforward example of how to design a system. It is perhaps the most complete text available on how to design for cleaner air.

Design of Industrial Exhaust Systems, 3rd Edition, by John L. Alden, 256 pages, 137 illustrations, indexed, 6 x 9, cloth. The Industrial Press, 93 Worth St., New York 13, N. Y. $6.00.

STANDARDS FOR RESIDENTIAL POOLS—Recommended minimum standards for residential swimming pools has been issued by the National Swimming Pool Institute. These recommendations cover filters, piping, valves, and other details. National Swimming Pool Institute, Harvard State Bank Building, Harvard, Ill.

(Concluded on page 124)

THE BIG ONES COME TO BURNHAM

Architects
PERKINS & WILL
White Plains, N. Y.

Consulting Engineers
JAROS, BAUM AND BOLLES
New York City

Heating Contractors
HEATING MAINTENANCE CORP. OF N. Y.
New York City

New "Dream School" heats with giant Burnham Scotch-Type Steel Boilers

Two Scotch-Type boilers of the largest size that can be built as a single unit for transportation are being used in "the dream school of the East" . . . the new High School in White Plains, N. Y.

These efficient Burnham Steel Boilers for heavy oil firing are approximately 10 feet in diameter and 25 feet long. With 4,000 sq. ft. of heating surface, each can develop 800 boiler horsepower. In addition, the school uses two smaller Burnham Scotch-Type Steel Boilers in stock sizes . . . one with 2,500 sq. ft. of heating surface and one with 715 sq. ft.

Burnham Scotch-Type Steel Boilers are also available as completely packaged units. You get the ideal combination of boiler and burner for heavy oil, light oil, gas or oil/gas combination. Standard capacities range from 2,930 to 39,370 sq. ft. net E.D.R. steam.

Also available for prompt shipment: Compact-Type Table I and Table II Steel Boilers

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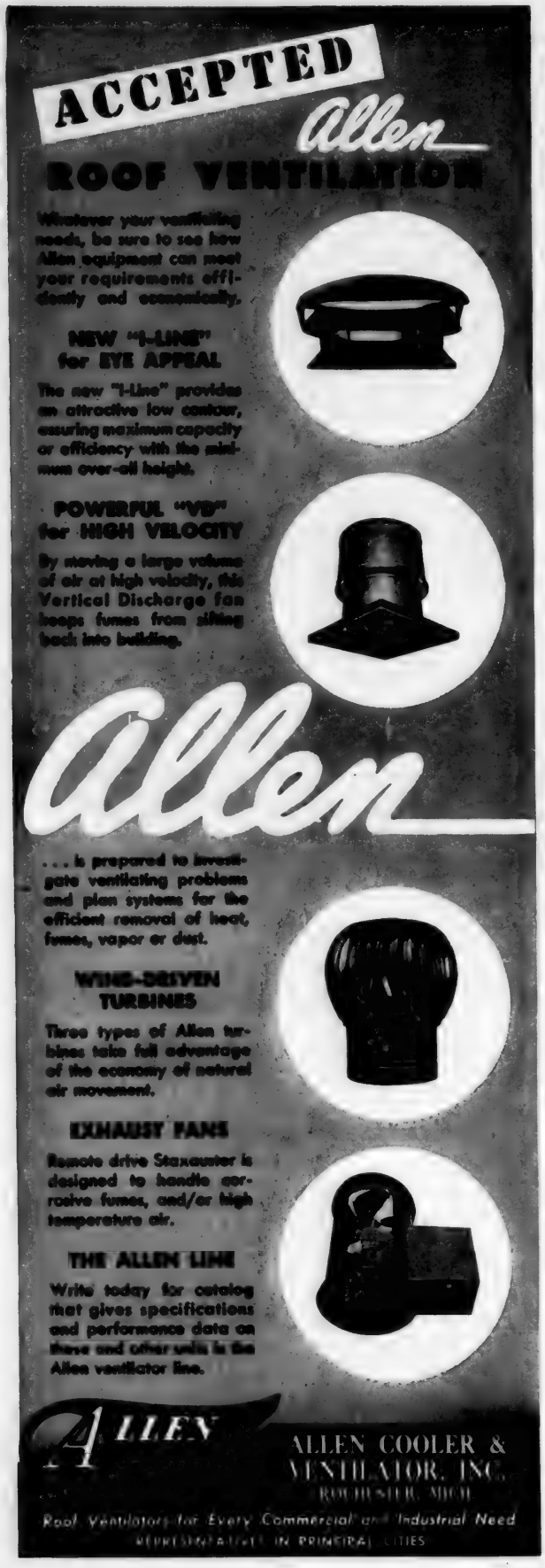
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Allen
ROOF VENTILATION
Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.
NEW "I-LINE" for EYE APPEAL
The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.
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By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.
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. . . is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.
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Three types of Allen turbines take full advantage of the economy of natural air movement.
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Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.
THE ALLEN LINE
Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.
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ALLEN COOLER & VENTILATOR, INC.
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Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES

(Concluded from page 122)

DRYING FARM CROPS, by Carl W. Hall—A second printing of this 1957 publication has been published by Agricultural Consulting Associates, Inc. Of interest to air handling engineers are data on energy requirements for drying, equilibrium moisture contents of various crops, air flow resistances of grains and hay, theory of drying, systems and equipment for drying. Both practical and technical phases are presented. The book can be purchased from Edwards Brothers, Inc., Ann Arbor, Michigan. 360 pages. $7.00.

STANDARDS OF THE HYDRAULIC INSTITUTE—The tenth edition of the standards has been revised and these revised pages are printed on colored stock for insertion in the original loose leaf binder. Price, $1.25 per set. Hydraulic Institute, 122 E. 42nd St., New York 17, N. Y.

WHAT READERS SAY

Electric Heating

EDITOR, Air Conditioning, Heating and Ventilating

I was disheartened to read the article entitled "Electric Heating for an Elementary School" in your June issue of ACHV, since, in its brevity, it grossly misrepresents the facts regarding the cost of installing and operation of electric resistance heating systems.

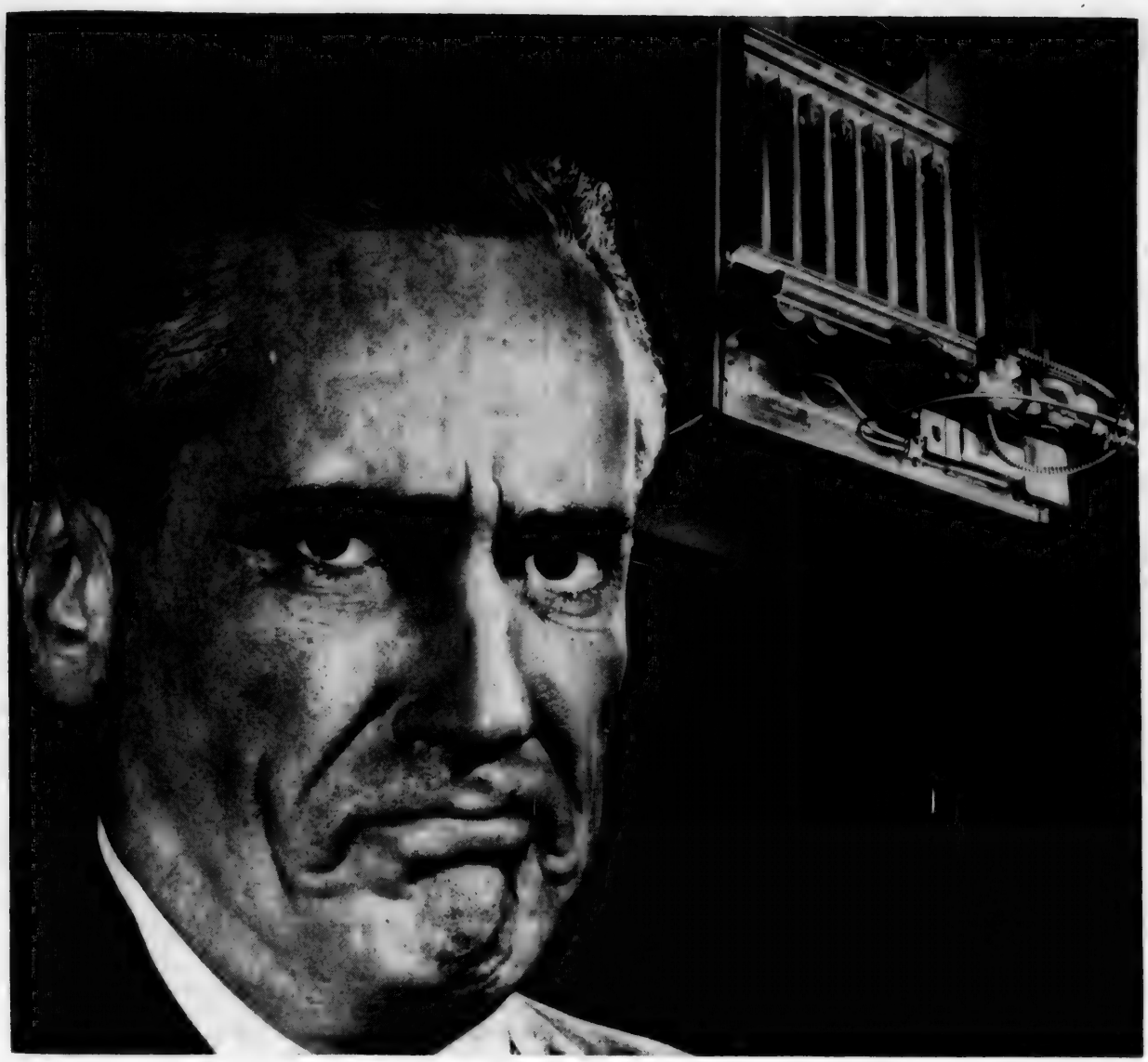
This article implies that Mr. C. S. Buchart, consulting engineer, has uncovered heretofore unknown facts, which, when applied to this electric resistance heating application, results in an installation which is competitive to "conventional systems." Experience with electric heating in the Chicago area has assured us that this is not true, since similar applications show by actual cost records that heating by electricity has amounted to more than 2½ times that required for an oil-fired conventional system for similar buildings, not nearly so well insulated. The cost for electricity for heating in this area is 1¾c per kwh after the initial demand charges.

The taxpayers supporting this local school are victims of the smoke screen put up by the electric power company, wherein the facts regarding electric heating costs have been misrepresented. Comparisons have been made to the cost of conventional systems designed and installed in other schools of various sizes and construction, none of which have storm windows or side-wall insulation, nor is this added to the initial cost of the electric systems.

It would seem in order for the author of this article to justify the costs shown, inasmuch as his statements indicate he has analyzed this problem in detail. It would be of interest for him to explain what provisions have been made for water heating and incineration.

Donald H. Snyder
Association Engineer

Mechanical Contractors Chicago Association
Chicago, Ill.



TOUGH BUYERS

DEMAND REZNOR STAINLESS STEEL DUCT FURNACES

BECAUSE THE HEAT EXCHANGER AND BURNERS CANNOT CORRODE!

The plumbing, heating or air conditioning contractor has to be a tough buyer. He has to look ahead and consider possible trouble makers like corrosion in air conditioning, make-up or ventilation air systems. That's why so many contractors demand Reznor *stainless steel* duct furnaces: they *can't* corrode!

LOWER FUEL COSTS, TOO —The tough buyer wants to make sure his customers get even heat and lower fuel costs. That's why he appreciates Reznor "extras," like the gas modulating valve. As discharge temperatures rise, the valve cuts gas input to 20% of rated capacity, then shuts off the supply completely.

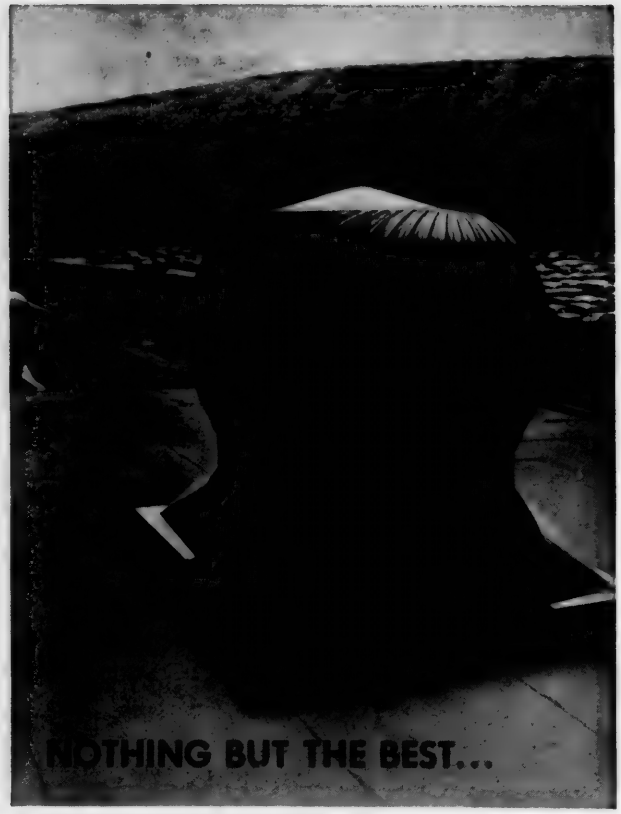
CHECK THE "TOUGH BUYERS' LINE" You can order and install Reznor duct furnaces in capacities up to 300,000 Btu. Use them in multiples for greater heat requirements. Buy matching Reznor blowers.

For the full story, phone your local Reznor distributor, or write to Reznor Manufacturing Company, Dept. 64B, Mercer, Pennsylvania.

THE HEATING WORLD IS FULL OF TOUGH BUYERS; THAT'S WHY REZNOR IS THE WORLD'S LARGEST SELLING DIRECT-FIRED HEATER!

REZNOR HEATERS

"THE TOUGH BUYERS' LINE"



Western Rotary® Roof Ventilators

with Lifetime Guaranteed Bearings

- "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity, no backdraft ever.
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- Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

HEAT TRANSFER CONFERENCE—Sponsored by American Society of Mechanical Engineers and American Institute of Chemical Engineers, Heat Transfer Conference, University of Connecticut, Storrs, Conn. ASME Secretary, O. B. Schier, II, 29 W. 39th St., New York 18, N. Y. ..... **AUGUST 9-12, 1959.**

CRYOGENIC ENGINEERING CONFERENCE—1959 Cryogenic Engineering Conference to be held at the University of California, Berkeley, Calif. K. D. Timmerhaus, secretary of the Conference, Chemical Engineering Dep't., University of Colorado, Boulder, Colo. ..... **SEPTEMBER 2-4, 1959.**

INDUSTRIAL GAS SCHOOL—Industrial gas school of the American Gas Association, Penn-Sheraton Hotel, Pittsburgh, Pa. Ralbern H. Murray, American Gas Association, 420 Lexington Ave., New York 17, N. Y. ..... **SEPTEMBER 14-18, 1959.**

MANAGEMENT CONFERENCE—Engineering management conference sponsored by ASME and AIEE at the Statler-Hilton Hotel, Los Angeles, Calif. ASME secretary, O. B. Schier II, 29 W. 39th St., New York 18, N. Y. ..... **SEPTEMBER 17-18, 1959.**

PETROLEUM CONFERENCE—Petroleum Mechanical Engineering Conference at Rice Hotel, Houston, Tex. ASME secretary, O. B. Schier II, 29 W. 39th St., New York 18, N. Y. ..... **SEPTEMBER 20-23, 1959.**

ISA INSTRUMENT-AUTOMATION EXHIBIT—14th annual Instrument-Automation Conference and Exhibit of the Instrument Society of America, at the International Amphitheatre, Chicago, Ill. H. S. Kindler, ISA, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **SEPTEMBER 21-25, 1959.**

POWER CONFERENCE—National Power Conference sponsored by ASME and AIEE at the Hotel Muehlebach, Kansas City, Mo. ASME secretary, O. B. Schier II, 29 W. 39th St., New York 18, N. Y. ..... **SEPTEMBER 27-OCTOBER 1, 1959.**

WELDING SOCIETY MEETING—Fall meeting of the American Welding Society, at the Sheraton-Cadillac Hotel, Detroit, Mich. A. L. Phillips, American Welding Society, 33 W. 39th St., New York 18, N. Y. ..... **SEPTEMBER 28-OCTOBER 1, 1959.**

AGA CONVENTION—Annual convention of the American Gas Association, at the Conrad-Hilton Hotel, Chicago, Ill. C. S. Stackpole, managing director of the Association, 420 Lexington Ave., New York 17, N. Y. ..... **OCTOBER 5-7, 1959.**

ASA CONFERENCE—10th National conference on Standards, at the Sheraton-Cadillac Hotel, Detroit, Mich. Secretary of the Association, 70 E. 45th St., New York 17, N. Y. ..... **OCTOBER 20-22, 1959.**

FUELS CONFERENCE—Fuels Conference sponsored by ASME and AIME at Netherland Hilton Hotel, Cincinnati, Ohio. ASME secretary, O. B. Schier II, 29 W. 39th St., New York 18, N. Y. ..... **OCTOBER 26-29, 1959.**

REFRIGERATION SERVICE ENGINEERS CONVENTION—Convention of the Refrigeration Service Engineers Society, at the Ambassador Hotel, Atlantic City, N. J. Secretary of the Society, 433 No. Waller Ave., Chicago, Ill. ..... **OCTOBER 30-NOVEMBER 2, 1959.**

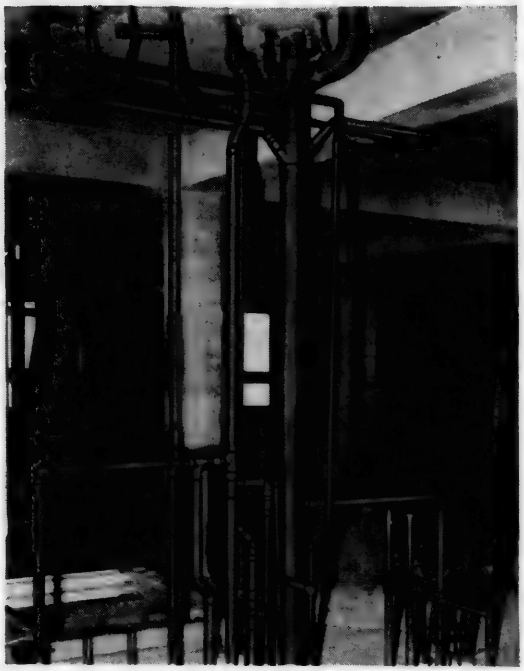
AIR CONDITIONING WHOLESALERS MEETING—Annual meeting of the Air-Conditioning and Refrigeration Wholesalers, in Atlantic City, N. J. Secretary, 2607 N. High St., Columbus, Ohio. ..... **NOVEMBER 1-2, 1959.**

ARI EXPOSITION—11th Exposition of the Air-Conditioning and Refrigeration Industry at Convention Hall, Atlantic City, N. J. Geo. S. Jones, Jr., managing director of Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. ..... **NOVEMBER 2-5, 1959.**

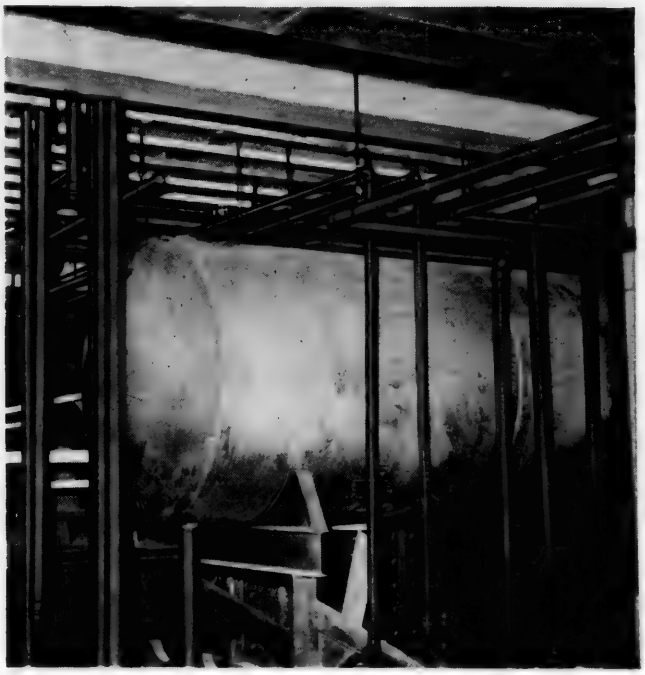
(Concluded on page 128)

ALL-COPPER

plumbing chosen for new Butte hospital because it cost no more—saved space—offered economies in maintenance



WATER SUPPLY AND SANITARY DRAINAGE. Roughed-in piping system for rest rooms and therapy service shows how compact assemblies of copper tube and solder-joint fittings save valuable floor and overhead space. General Contractor was Dan J. Mooney, Butte, Mont.



HEATING SYSTEM: Copper tube piping for hot-water heating system, awaiting installation of boilers. Over 6 miles of Anaconda copper tube in sizes up to 6" and about 10,000 Anaconda wrought-copper and cast-brass solder-joint fittings for plumbing and heating system supplied through M & L Supply Co., Inc., plumbing wholesaler, Butte, Mont.

The $2,100,000 Silver Bow County Hospital, Butte, Montana, is the first major public building in the state to have all-copper plumbing—for sanitary drainage lines, water supply, and heating.

What the architect says: "In specifying materials to be used in a building, we feel it incumbent on the architect to select those materials that have longer life and contribute to low maintenance costs. For this reason, we selected copper tube for all plumbing lines in Silver Bow County Hospital. In a hospital there are many plumbing lines; they are all concealed; and the use of less durable materials would not give true economy in the operation of the building." Norman J. Hamill, Norman J. Hamill & Associates, A.I.A., Butte, Montana, and Idaho Falls, Idaho.

What the plumbing contractor says: "In a hospital, intricate systems are the rule rather than the exception and the use of copper in Silver Bow County Hospital made it possible to complete all lines with greater ease and speed than would have been possible with other materials. . . . Copper tube requires less space in partitions and other areas of concentrated services. Its use also made it possible to fabricate bends, connections, etc., at a workbench with the result that final installations were made in one operation with a minimum of effort. . . . Particularly in hard-to-get-at places overhead, copper's lighter weight than other materials was a factor that appealed to us." Floyd J. Stewart, Reardon Plumbing & Heating Co., Butte, Montana.

For more information on ALL-COPPER plumbing, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

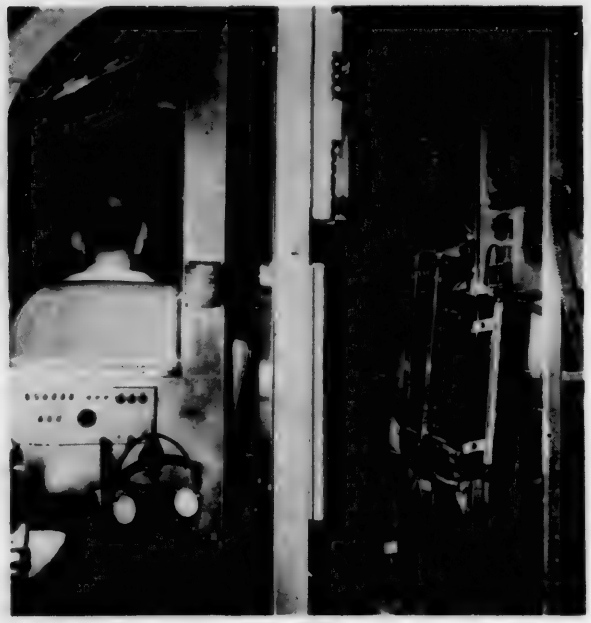
5906

ANACONDA®

COPPER TUBE AND FITTINGS

PRODUCTS OF THE AMERICAN BRASS COMPANY

Available through Plumbing Wholesalers



Interior view EAL DC-7 B simulator.

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Helps Keep Pilots Cool

In a business where safety is paramount, pilot efficiency and equipment dependability are prerequisites. And, in the flight simulator building* of Eastern Air Lines in Miami, four big Thermal central plant units prove their dependability to provide year 'round comfort for flight personnel practicing instrument flying.

Thermal Engineering manufactures a complete line of air conditioning and ventilating equipment for every climate and to fit all architectural requirements. To see how easily, economically and efficiently Thermal equipment will fit into your new building or remodeling plans write for complete information on Thermal central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers.

*Architects: Stewart-Skinner Associates, Miami
Consulting Engineers: R. L. Duffer & Associates, Miami
Thermal Agent: A. C. Dean Co., Miami

Agents in principal cities.

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

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HOUSTON 19, TEXAS

(Concluded from page 126)

METAL EXPOSITION & CONGRESS—41st National Metal Exposition & Congress, sponsored by the American Society for Metals, at the International Amphitheatre, Chicago, Ill. Seward Covert & Associates, 1059 Leader Bldg., Cleveland 14, Ohio. ..... **NOVEMBER 2-6, 1959.**

HOTEL EXPOSITION—National Hotel Exposition, New York Coliseum, New York, N. Y. ..... **NOVEMBER 2-6, 1959.**

CONTROL CONFERENCE—National Automatic Control Conference, sponsored by ASME, IRE, AIEE ISA, Sheraton Hotel, Dallas, Tex. ASME Secretary, O. B. Schier, II, 29 W. 39th St., New York 18, N. Y. ..... **NOVEMBER 4-6, 1959.**

CEC SEMI-ANNUAL MEETING—Consulting Engineers Council, Board of Directors semi-annual meeting, Cincinnati, Ohio (hotel to be selected). Executive Secretary, L. N. Spiller, 326 Reisch Building, Springfield, Ill. ..... **NOVEMBER 4-7, 1959.**

COMMERCIAL KITCHEN PLANNING—Seminar on commercial kitchen planning at Michigan State University, East Lansing, Mich. Ralbern H. Murray, American Gas Association, 420 Lexington Ave., New York 17, N. Y. ..... **NOVEMBER 9-13, 1959.**

ASME ANNUAL MEETING—Annual meeting of the American Society of Mechanical Engineers, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, O. B. Schier, II, 29 W. 39th St., New York 18, N. Y. ..... **NOVEMBER 29-DECEMBER 4, 1959.**

WARM AIR HEATING CONVENTION—Annual convention of the National Warm Air Heating and Air Conditioning Association, at the Chase Hotel, St. Louis, Mo. G. Boeddener, managing director of the Association, 640 Engineers Bldg., Cleveland 14, Ohio. ..... **DECEMBER 1-4, 1959.**

ASHRAE MEETING—Semi-annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, and the 2nd Southwest Heating and Air-Conditioning Exposition, sponsored by ASHRAE, in Dallas, Tex. The meeting will be at the Baker and Adolphus Hotels, and the Exposition in the Memorial Auditorium. Secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **FEBRUARY 1-4, 1960.**

ISA INSTRUMENT-AUTOMATION EXHIBIT—ISA Instrument-Automation Conference and Exhibit, at the Houston Coliseum, Houston, Tex. W. H. Kushnick, executive director, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **FEBRUARY 1-5, 1960.**

GAMA MEETING—Annual Meeting of the Gas Appliance Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Va. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **MARCH 30-APRIL 1, 1960.**

OHI EXPOSITION AND CONVENTION—23rd National Oil Heat and Air Conditioning Exposition, at the New York Coliseum, held concurrently with the 28th annual convention of OHI, at the Park-Sheraton Hotel, New York City. Secretary, Oil Heat Institute of America, Inc., 500 Fifth Ave., New York 36, N. Y. ..... **APRIL 4-7, 1960.**

WELDING SOCIETY MEETING—41st annual Meeting and Welding Exposition of the American Welding Society in Los Angeles Calif. Headquarters to be announced later. A. L. Phillips, secretary of the Society, 33 W. 39th St., New York 18, N. Y. ..... **APRIL 25-29, 1960**

WESTERN EXPOSITION—Third Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference, Shrine Exposition Hall, Los Angeles, Calif. F. J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles 7, Calif. Exhibit sponsored by Western Air Conditioning Industries Association. ..... **APRIL 27-30, 1960.**

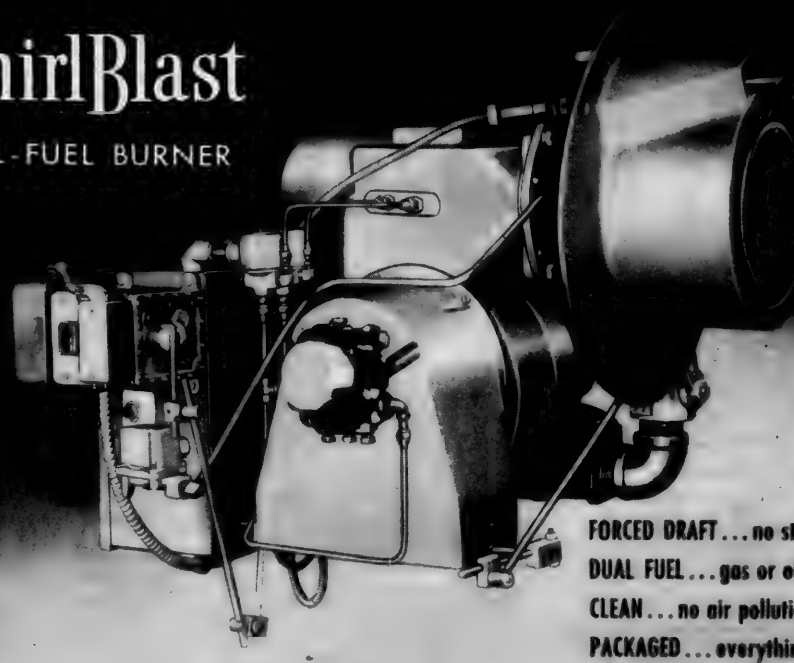
METAL EXPOSITION & CONGRESS—2nd Southwestern Metal Exposition & Congress, at State Fair Park, Automobile Building, Dallas, Tex. C. L. Wells, exposition manager, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. ..... **MAY 9-13, 1960.**

CONGRESS ON OCCUPATIONAL HEALTH—13th International Congress on Occupational Health, first to be held in the Western Hemisphere, at the Waldorf Astoria Hotel, New York City. Dr. Leo Wade, organizing committee, 15 W. 51st St., New York 19, N. Y. ..... **JULY 25-29, 1960.**

A new development by Iron Fireman

WhirlBlast

DUAL-FUEL BURNER



FORCED DRAFT... no stack draft required
DUAL FUEL... gas or oil — instant changeover
CLEAN... no air pollution
PACKAGED... everything built-in, ready to go

New high in combustion efficiency and fuel economy

with this revolutionary burner for medium size boilers

This compact Iron Fireman WhirlBlast unit combines many of the advantages of big burners, yet it requires little more supervision than the oil or gas burner in your home.

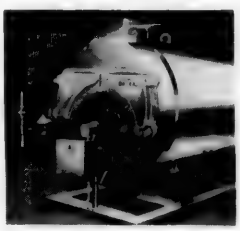
No stack—no draft problems. Air supply is precisely controlled under all conditions. The WhirlBlast burner eliminates the need for a costly and unsightly smokestack, and also eliminates the noise, bulk and high power requirements of induced draft firing. This burner starts clean and burns clean, with no soot or smoke problems.

Steadiest flame ever developed. In the new WhirlBlast firing head Iron Fireman engineers have solved the persistent problem of flame pulsation. A clean, steady, efficient flame is achieved without firebox vents or any other makeshift device.

Fires gas or light oil; changes fuels instantly. Quick fuel changeover can be accomplished with the flick of a switch, or automatically with special controls. Models available for firing either gas or oil exclusively.

A true "package". When you bolt the WhirlBlast unit to the boiler front you install a complete forced draft firing system, combining air and fuel systems and integral electronic combustion controls. It leaves the factory as an operating unit, factory wired and tested. Does not require refractory combustion chamber, nor any provision for secondary air supply.

For all types of boilers. The WhirlBlast burner can be purchased in two ways: as a boiler-burner unit (shown at right), or as a burner alone for use in your present boiler.



Complete boiler-burner unit, ready to operate. Boiler and burner compose a single unit, engineered, assembled, wired and tested at the factory, carrying factory responsibility. Requires little more than service connections when delivered to the job. Sizes from 15 to 100 boiler horsepower.

Send for more information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING CO.
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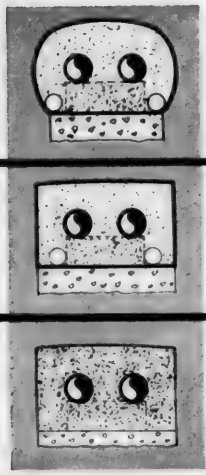
Please send me more information and specifications on the Iron Fireman WhirlBlast burner.

Name .....
Firm .....
Address .....
City ..... Zone ..... State .....

NOW Concrete Thermal Casings, Inc.
offers you
Three improved
customized systems of

UNDERGROUND PIPE INSULATION

matched to the construction specifications of
any school, institution or military installation



CTC
CASED
THERMAL CONCRETE

For your jobs in which water is expected to be over the conduit.

MEETS GOVERNMENT SPECIFICATIONS

"Zcrete"
INSULATING
CONCRETE CONDUIT

For your jobs in which water may be over the conduit periodically.

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WATER RESISTANT
MONOLITHIC CONDUIT

For your jobs in which rain or irrigation water may stand over conduit occasionally.

ONE of these three widely successful conduit systems is the right choice for particular sub-surface conditions and job engineering considerations.

Contact the certified CTC Contractor near you for qualified information and estimates on the system best suited to your requirements.

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ROHRER ROOF DECKS, INC.
Kansas City, Kansas

UNDERGROUND CONDUIT CORP.
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UTAH PIONEER CORP.
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VERMICULITE CONTRACTORS, INC.
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FOR QUICK FACTS

to help choose the system matched to necessary performance or cost factors, ask for Bulletin B1.

CONCRETE THERMAL CASINGS, Inc.

2107 NO. 34TH STREET • SEATTLE 3, WASHINGTON

3020 Grant St., Evanston, Ill. P. O. Box 267, Canton, Mass.

(Continued from page 14)

The new reesearch house was described by Warren S. Harris, research professor at the University of Illinois, as a tri-level dwelling that reflects current architectural trends and incorporates many "hard-to-heat" and "hard-to-cool" design features.

New tri-level I-B-R Hydronic Research House will be used for studies of forced hot water heating, chilled water cooling, indirect water heating for hot tap water, and snow-melting.

Professor Harris explained that the industry's heating and cooling equipment would be put through severe tests. Use of large glass areas, cathedral-type ceilings, and other modern design features will make possible a study of a wide range of current and future heating and cooling problems.

Construction of the new 10 room, 2½ bath research house was completed recently in Urbana, Ill., where the Institute has conducted a home heating and cooling reesarch program in cooperation with the University of Illinois since 1940.

To begin about April 1, a new session of the I-B-R school will include two new I-B-R publications as text books. Several of the existing I-B-R Guides that have been used as text books in the course will be revised, based on results of latest hydronics research.

One of the new publications, to be released shortly, will cover methods of reducing installation costs. The other will provide details of installation techniques for the small pipe hydronic system which was developed and tested last winter in the old I-B-R Research Home. The small pipe system uses flexible tubing with diameters as small as one-quarter of an inch.

(Concluded on page 132)

Climate by Chrysler

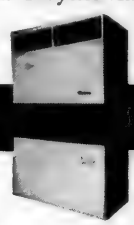
. . . secret ingredient in the formula for a contented client

"Chrysler's exclusive all-weather control assures ideal indoor climate all year long . . . regardless of outdoor temperature. This control permits cooling for perfect comfort in hot interior zones, even when the temperature drops to zero outside."

"I specified Chrysler packaged air conditioning for my client for three important reasons. *Special features:* Only Chrysler includes—as standard equipment—features like all-weather control and an electronic motor control that would cost up to $364 per unit to add to ordinary air conditioning. *Low operating costs:* Chrysler's new Power Miser compressor keeps power bills down. *Dependability:* Chrysler has a 25-year reputation for low service and maintenance costs."

"We needed a versatile air conditioning installation for a multiple-use building like ours where every work zone requires a different kind of climate. We got it with Chrysler packaged air conditioning. Chrysler offers the largest selection of equipment combinations in the industry . . . with the exact type and capacity for every job."

With Climate by Chrysler, you offer your clients much more than just coolness for their air conditioning investment. Before you figure your next job, why not get all the facts on Chrysler Packaged Air Conditioning. Contact your local Chrysler Airtemp Distributor. Or write direct.

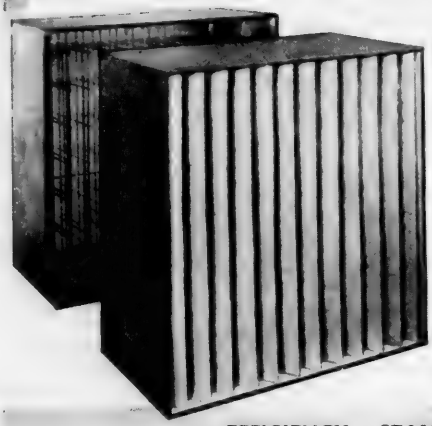


CHRYSLER
AIRTEMP

Airtemp Division, Chrysler Corporation, Dept. I-89, Dayton 1, Ohio
Canadian Distributor: Therm-O-Rite Products, Ltd., Toronto, Ontario

The Cambridge AEROSOLVE® Filter is the RELIABLE Filter

- High Efficiency
- Positive Filtration
- Low Pressure Drop
- Easy Installation & Maintenance
- High Velocity — 450 FPM
- Expert Technical Assistance



Be specific about filter efficiencies

Compare!

EFFICIENCY — STANDARD TESTS

TYPE FILTER	WEIGHT TEST (Synthetic Dust)	NBS TEST # METHOD (Atmospheric Dust)	DOP TEST (0.3 Micron Smoke)
Cambridge ABSOLUTE®	*	*	**99.97 Min.
Cambridge MICRETAIN	*	99	95
Cambridge AEROSOLVE® 95	*	90-95	80-85
Cambridge AEROSOLVE 85	99	80-85	50-60
Cambridge AEROSOLVE 35	96	30-35	20-30
Electronic Precipitator	99	85-90	60-70
Pleated Paper	94	25-30	15-20
2" Cleanable	76	8-12	2-5
2" Throwaway	76	8-12	2-5

*Practically 100%. Test not practical for more accurate reading.
#National Bureau of Standards Discoloration Test.
**Maximum Allowable Penetration of Dioctyl Phthalate Smoke 0.03%. Every filter individually tested.

Cambridge AEROSOLVE cartridges of 95%, 85% and 35% efficiency are all interchangeable for easy adjustment to future efficiency requirements.

Write for Bulletin 132

Cambridge Filter Corporation
734 E. Erie Blvd., Syracuse 1, N. Y.

Pioneers in High Efficiency Air Cleaning

REPRESENTATIVES IN PRINCIPAL CITIES

(Concluded from page 130)

CERTIFICATION PROGRAM

of ARI meeting with positive response from dealers, according to nine-city, nation-wide survey.

Its Unitary Certification Program, launched only last January, is meeting with enthusiastic response from dealers, states Air-Conditioning and Refrigeration Institute, Washington, D.C., on the basis of a series of interviews with air-conditioning dealers in Philadelphia, New York, Chicago, San Francisco, Fort Worth, Birmingham, Miami, Cedar Rapids, and Washington, D.C.

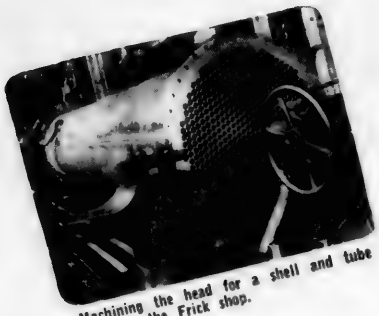
Of thirty-three dealers interviewed, twenty-seven of them, or 82 per cent, not only were aware of the program, but accurately described its purpose and showed a keen awareness of the benefits to the industry. The interviews were conducted by representatives of Walter Gerson & Associates, Washington, D. C. market researchers.

As a spot check, the twenty-seven dealers who knew of the program were asked to state in their own words what they thought the purposes of the program were.

All of them gave accurate responses, with the two most frequently mentioned being: (1) to prevent misrepresentation to the public and, (2) to prevent unfair competition from unethical dealers.

The dealers were in almost universal agreement that the ARI Seal and the Unitary Certification Program will prove to be powerful sales tools in the coming months. A more extensive survey of dealer attitudes is contemplated at a later date.

The Institute has issued a new edition of its Directory of Certified Unitary Air-Conditioners for the period July 1 to September 30, 1959. It supersedes all previous directories and supplements. Rating data on 1,611 models are included, the products of 41 of 47 manufacturers participating in the program, which is jointly sponsored by ARI and National Warm Air Heating and Air Conditioning Association. The 47 manufacturers account for over 80% of the units made.



Machining the head for a shell and tube vessel in the Frick shop.

TRADE FRICK MARK

SHELL VESSELS

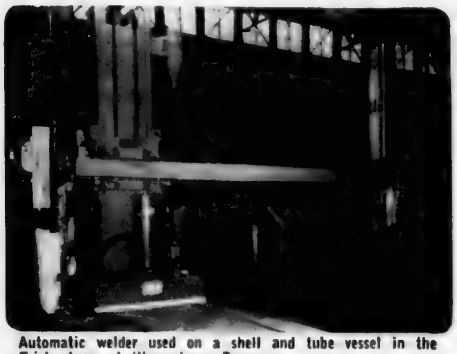
With 106 Years' experience in building pressure vessels . . . from boilers to reactors, we're able and ready to fill all your needs.

Condensers, Receivers, Oil Separators, Gas and Liquid Coolers, Accumulators, and Pre-coolers are furnished in all sizes.

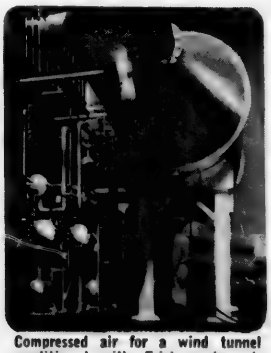
We have the shears, planers, power rolls, automatic welders and mechanics to meet all ASME standards.

WRITE FOR RECOMMENDATIONS AND ESTIMATES ON YOUR SHELL VESSEL WORK TO . .

FRICK COMPANY• WAYNESBORO, PENNSYLVANIA



Automatic welder used on a shell and tube vessel in the Frick shops at Waynesboro, Penna.



Compressed air for a wind tunnel conditioned with Frick equipment.

Frick reactor shells are built by ASME qualified welders.

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ANSWERS YOUR TELEPHONE 24 HOURS EVERY DAY

Let us Answer Your Emergency Calls . . . Dispatch and Route Your Servicemen.

Offices everywhere, Answer America's efficient secretaries will promptly call your servicemen. This new network of telephone answering exchanges covering most cities in United States, Canada and Mexico, will increase your business and offer more efficient service to your customers. For complete information, write Answer America or look for Answer America in the white section of your telephone directory, or call Information.

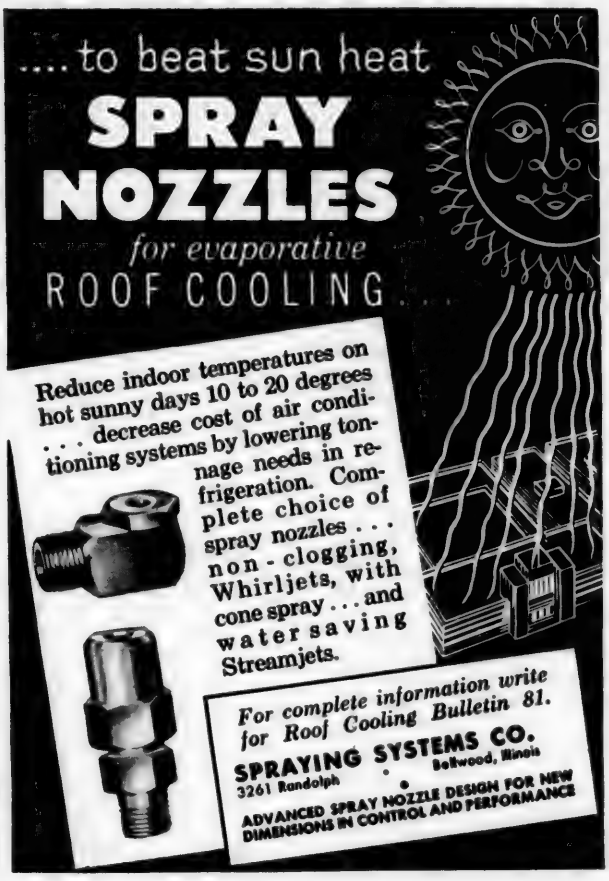
ANSWER AMERICA, INC.

55 East Washington St., Chicago 2, Ill., RAndolph 6-2339

....to beat sun heat

SPRAY NOZZLES

for evaporative ROOF COOLING...



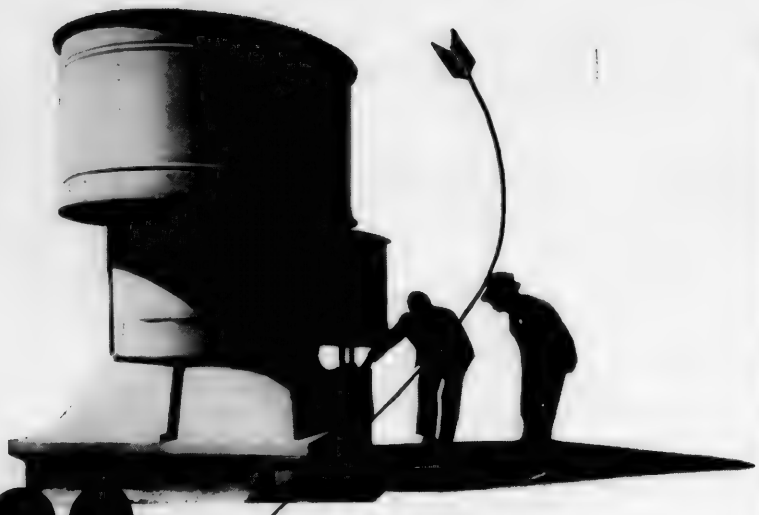
Reduce indoor temperatures on hot sunny days 10 to 20 degrees . . . decrease cost of air conditioning systems by lowering tonnage needs in refrigeration. Complete choice of spray nozzles . . . non-clogging, Whirljets, with cone spray . . . and water saving Streamjets.

For complete information write for Roof Cooling Bulletin 81.

SPRAYING SYSTEMS CO.

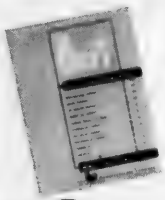
3261 Randolph • Bellwood, Illinois

ADVANCED SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE



36 Burt Free Exhaust Fan Ventilators Rout Heat and Fumes Fast in TRUE TEMPER'S New Saybrook Forge Plant

Designed and built by The Austin Company, Cleveland, Ohio, True Temper's multi-million-dollar Saybrook Forge Plant uses eighteen 54" and eighteen 42" Burt Free Exhaust Fan ventilators to provide a two-minute air change dependably and economically . . . The entire discharge in Burt Free Exhaust Fan ventilators is vertically upward, with no internal baffles to impede the full flow of air. This highly efficient design provides power capacities of 41,700 cfm for each 54" ventilator and 24,000 cfm for each 42" unit . . . Fresh air at low cost is available for your plants, too, from Burt's complete line. There's a type and size for every ventilating need.



Send for FREE Data Book!

Write for Burt Data Book SPV-101G. It supplies quick data on Burt's complete line of modern Roof Ventilators.

FAN & GRAVITY VENTILATORS | LOUVERS | SHEET METAL SPECIALTIES

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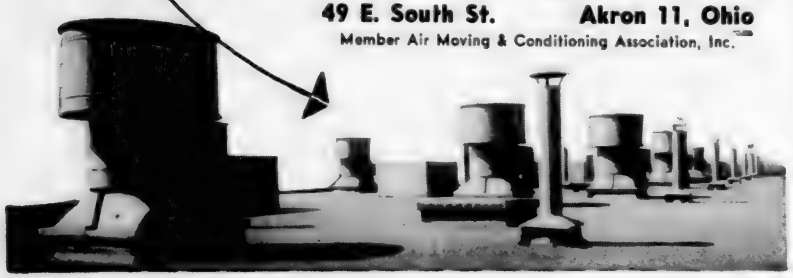
Member Air Moving & Conditioning Association, Inc.



BRIEFLY STATED NEWS ITEMS

William E. Fenner and Charles Y. Proffitt have announced the formation of the firm of FENNER AND PROFFITT, CONSULTING ENGINEERS, with offices at 107 Rountree St., Wilson, N. C. Mr. Fenner, holder of a BSME degree from Duke University, was previously with the consulting engineering firms of Zumwalt and Vinther, Dallas, Tex., and L. E. Wooten & Co., Consulting Engineers, Raleigh, N. C., and has been in private practice in Raleigh for the past year and one-half. Mr. Proffitt, a graduate of N. C. State College in electrical engineering, has previously worked for B. O. Vannort Engineers Inc., Charlotte, N. C., was a field engineer for the Rural Electrification Administration for six years, and for the past five years has been with L. E. Wooten & Co. . . .

The VIRGINIA SOCIETY OF PROFESSIONAL ENGINEERS' CHARLOTTESVILLE CHAPTER announces the election of E. M. Mittendorff, Charlottesville, president for the 1959-1960 chapter year. Elected vice-president is Joseph Devoy of Waynesboro; and Charles E. Echols of Charlottesville is the new secretary-treasurer. Mr. Mittendorff is a past president of the Illinois Chapter of ASHRAE and a member of the TAC on steam and hot water heating. For the past nine years he has been director of utilities and lecturer in mechanical engineering at the University of Virginia. . .

Plumbing inspector Robert H. Watson, Elkhart, Ind., is the recipient of the 1959 Copper & Brass Achievement Award. In 1928 Mr. Watson set up shop in Elkhart as plumbing contractor and installed the first piping job in Elkhart that was done in copper with flared fittings. In 1932 he installed an exhibition job of copper piping in a new heating installation in Chicago for an executive of American Radiator Company, the first usage of

copper for heating lines. The code which he engineered as plumbing inspector has become a model which many cities and the National Code have used as a basic guide to define the practical usage of copper in plumbing, heating and drainage applications on an economical basis. He is an active member of the Indiana Chapter and of the national AMERICAN SOCIETY OF SANITARY ENGINEERING.

NEW OUTLETS

Crutcher-Rolfs-Cummings, Inc., with general headquarters in Houston, Tex., a branch office in Farmington, N. Mex., and a Canadian operation, known as Canadian Equipment Sales & Service Co., Ltd., located in Edmonton, Alberta, has been appointed distributor of the complete line of JOHNS-MANVILLE fiber glass pipe wrap products. The line includes reinforcing pipe wrap, outer wrap and hand wraps. . .

BALTIMORE AIRCOIL COMPANY, INC. announces the recent appointment of Paller Engineering Co., Indianapolis, Ind., to handle its condensers and towers. With a branch office in Fort Wayne, Paller will represent B.A.C. in Central and Northern Indiana. . .

A shift toward a new distribution pattern got underway with the announcement that CRANE COMPANY had turned forty-four markets over to independent wholesalers. The largest transfer took place in the company's former sixth sales district where Crane Co. of Minnesota was sold to the Ordway family for an undisclosed price. Crane Co. of Minnesota embraced 11 branches in five west north central states and was a sales subsidiary of Crane Co., Chicago. The branches will be operated under the name Crane & Ordway Co., continuing an association with Crane Co. that began in 1892. . .

THE TRANE COMPANY opened a new sub-office at 1029½ North Mills Street, Orlando, Fla. James A. Driver, 35, formerly of the company's Gainesville, Fla., office, has been assigned to the new sub-office. . .

Never before has the Henry Pratt slogan "Creative Engineering for Fluid Systems" been more aptly proven as truth—for creativity and experience have combined with a most sophisticated result—the totally new MONOFLANGE MK-II *

Stemming from four years of laboratory and field development, this compact and sensible valve will impress and delight those with a feeling for quality and economics.

The Monoflange MK-II is a versatile valve with a wide variety of sizes, materials, and operators—among which is the all new SIDEWINDER, a totally enclosed manual operator designed to be the perfect mate for the MK-II.

We believe this is a significant contribution to the valving art—one which will establish a new trend in the low price field. You will want one to test for yourself.

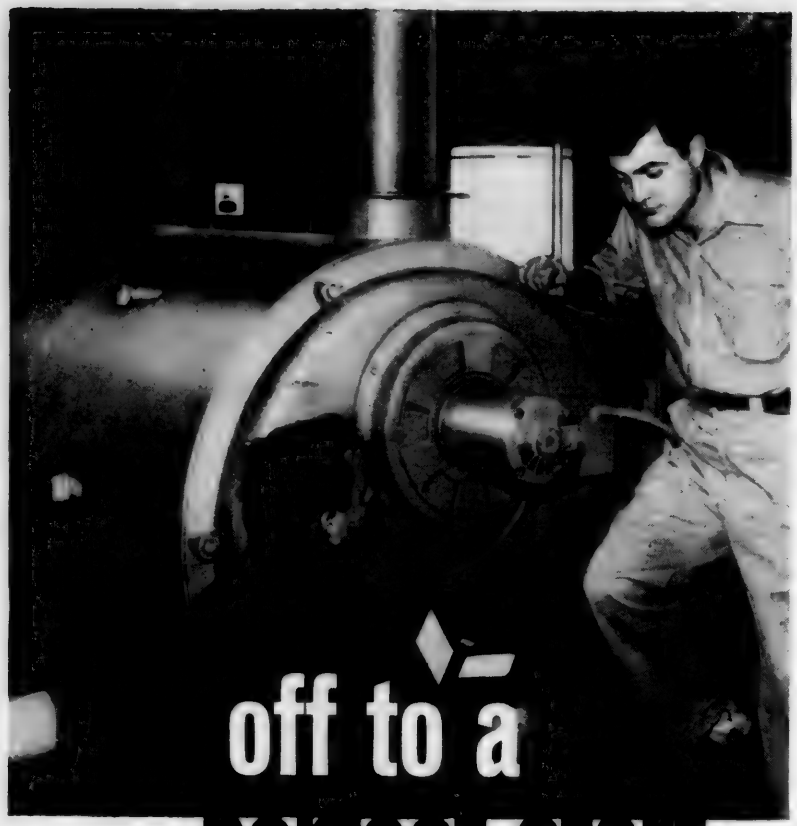
Write for bulletin 10 DA

Monoflange® MK-II
RUBBER SEAT BUTTERFLY VALVE

HENRY PRATT®

*Important things are happening at the Pratt Research Laboratories—as evidenced by this new product, the first of a series to be announced as part of the new line for 1960.

Henry Pratt Company, 319 West Van Buren St., Chicago 7, Illinois
Representatives in principal cities.



off to a perfect start

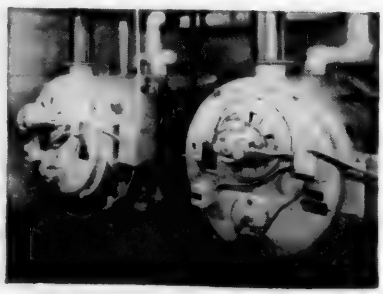
Cleaver-Brooks starting service sends Progress packaged boilers off to a right start . . . assures tip-top boiler performance . . . greater customer satisfaction.

This unique starting service is typical of many extra values you enjoy when you install America's finest commercial heating boiler . . . more evidence of Cleaver-Brooks undivided responsibility for boiler performance.

1. Every Progress boiler is started by a trained Cleaver-Brooks serviceman. He adjusts it carefully for fuels and loads on job site. This means fewer hours on the job for you . . . less cost . . . fewer call backs. It means superior performance, more satisfied customers.
2. Cleaver-Brooks serviceman trains the boiler attendant . . . instructs him in the care and operation of the boiler. This relieves you of the time and cost of this important follow-up responsibility.

Other important profit-making advantages in the Progress packaged heating boiler: packaged design, fully factory-tested, ready to install on the job site. Clean, quiet operation. High efficiency: 80% guaranteed. Hinged doors simplify maintenance.
Built by America's largest builder of packaged boilers.

Cleaver-Brooks Progress Boilers—seven sizes to 2,010,000 Btu.—for all types of commercial heating with oil, gas or combination oil/gas. Write: Dept. J, 315 E. Keefe Ave., Milwaukee 12, Wis.



Cleaver Brooks®
Progress
Packaged Heating Boiler

Briefly Stated

Thirteen certified specialty contractors across the country have already been licensed by CONCRETE THERMAL CASINGS, INC., Seattle, Wash., to install its three systems of underground pipe insulation. The growing network of certified contractors have the technical information necessary to counsel and quote on projects as well as handle the installation of the three systems using certified materials and procedure. Each contractor assumes undivided responsibility for the installation and performance of the systems. Certified contractors include: Insulation Industries (Pacific Vermiculite Contractors Ltd.), Vancouver, B.C.; MacArthur Co., St. Paul, Minn.; Sprinkmann Sons Construction Co., Milwaukee, Chicago, Peoria; Vermiculite Contractors, Inc., Seattle, Portland, Spokane; Weatherproofing Ltd., Montreal; Hoge-Warren-Zimmerman, Detroit, Akron; Underground Conduit Corp., Boston; Utah Pioneer Corp., Salt Lake City; Wagner-Smith Co., Dayton; Western Asbestos Co., San Francisco; Central Asbestos Co., Davenport, Iowa; J. B. Eurell, Philadelphia, Richmond, Va.; and Rohrer Roof Decks, Inc., Kansas City, Kansas. . .

E. W. Robinson Supply Co., 6505 Foster St., Houston, Tex., has been appointed distributor of JOHNS-MANVILLE asbestos pipeline felts and the complete line of fiber glass pipeline products. Since its establishment in 1953, Robinson Supply has been handling the fiber glass products manufactured by L.O.F. Glass Fibers Company which recently merged with Johns-Manville. Robinson's general headquarters are in Houston with branch operations in Denver, Colo., Ponca City and Tulsa, Okla., Dallas, Texas and Salt Lake City, Utah. . .

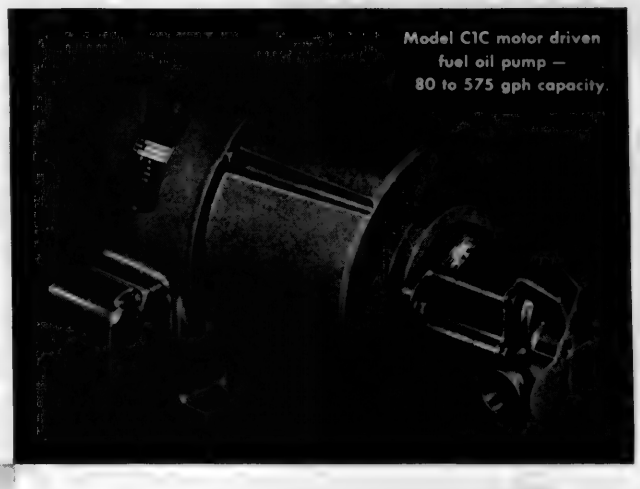
Three distributors have been appointed by A. M. BYERS Co., Pittsburgh, Pa., to handle the firm's 4-D wrought iron pipe. Norvell-Wilder Supply Co., Shreveport, La.; Hudson Pipe Nipple Mfg. Co., Brooklyn, N. Y., and J. R. Detering Co., Sacramento, Calif. . .

(Continued on page 138)

Webster fuel oil handling equipment

from tank to burner—
a complete line for all commercial and industrial applications

Problems in handling fuel oils? High lift, big capacity, heavy No. 5 and No. 6 grades? Webster has the answer in a full line-up of pumps—supply, transfer, booster and burner models. Choose from direct drive or belt-driven units—in a wide capacity range. Webster pumps are compact, install with a minimum of plumbing. With each you get a full measure of dependable operation to match the most rugged and demanding service.



Model C1C motor driven fuel oil pump — 80 to 575 gph capacity.

RV-2000 fuel oil regulating valve For all fuel oils — No. 1 through No. 6. Combines pressure regulation and cut-off. Capacities up to 100 gph. Pressure ranges — 80 to 150 psi, 90 to 250 psi.

call the man from Webster

— or write for engineering bulletins FU3-1, FU3-2, FU3-3

HEATING DIVISION
WEBSTER ELECTRIC
RACINE · WIS
our 50th year

Here's the LOW COST Answer to the Hot Water Problem for Coin-operated Laundries, Restaurants, Motels, Schools, Clinics, Apartments, Small Plants

EWING HEAVY-DUTY AUTOMATIC COMMERCIAL

Uses Any Type Gas

Vertical— Requires So Little Floor Space!

No Expensive Storage Tanks Needed!

Low Original Cost!
Economical Operation!
Trouble-Free Operation!
Simple To Install!
Automatic Controls!

Write or wire for prices and complete details

Hot Water Heater

Provides a constant, plentiful supply of 180 degree HOT WATER! Automatic TROUBLE-FREE operation! Compact! . . . Quickly and easily installed . . and ABSOLUTELY SAFE! Amazingly efficient and economical. Ask a Ewing user what he thinks of his Ewing heater.

THREE SIZES:—190,000—315,000—520,000 BTU input. Recovery capacities up to 500 gallons per hour at 100 degree temperature rise. Storage capacities 50 to 145 gallons. Inside surfaces treated with metal protective to assure long life and clean, clear water. Heavy duty magnesium rod incorporated with each unit.

Constructed in accordance with requirements of A.S.M.E. Boiler and Pressure Code. Each heater is registered with National Board of Boiler and Pressure Inspectors. All Safety controls listed by AGA.

Ewing MANUFACTURING CO.
2545 NW 10 P. O. BOX 873
OKLAHOMA CITY, OKLA.

for FUME

CONTROL

install

FLEXAUST HOSE

Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
For *all* kinds of fume and dust control, and ventilation uses.
Extremely flexible, durable, and lightweight.
Exceptionally easy to cut, install, connect, reuse, and relocate.
Sizes 1¼" thru 36" i.d.

Write for details today
Distributors
in all principal cities

THE FLEXAUST COMPANY
Dept. HV-8
0 PARK AVE., NEW YORK 17, N. Y.

Briefly Stated

(Continued from page 136)

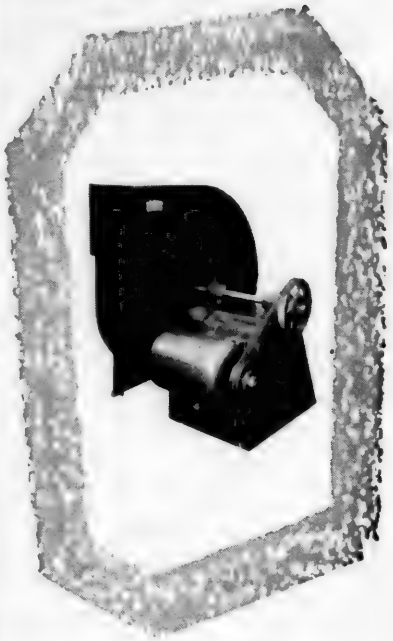
Harry J. Clark, administrator of the heating and air conditioning division, MODINE MFG. CO., Racine, Wis. has terminated his connection with the company to become president of a new corporation formed to represent Modine in the New York City sales territory. The new corporation of HAVCO, Inc. formed by Mr. Clark and his two associates, Sidney L. Gayle and Harry A. King, will handle the company's entire line of heating and air conditioning equipment. The address of the new firm is 70 E. 45th Street, New York City. . .

The following distributors of welding fittings, flanges, and other piping components have been named by TUBE TURNS DIVISION OF CHEMETRON CORP., Louisville, Ky.: Raritan Supply Co., Nixon, N. J., with display rooms in New Brunswick and Red Bank; New Hampshire Supply Co., Manchester, N. H.; National Plumbing & Heating Supply Co., Providence, R. I.; Charleston Supply Co., Charleston, S. C.; John Day Rubber & Supply Co., Omaha, Neb.; and C. S. Mersick Co., New Haven, Conn.

BURGEONING BUSINESS

Effective August 1, Ehret Magnesia Mfg. Co., Valley Forge, Pa., and Baldwin-Hill Co., Trenton, N. J., are merged. The new company, BALDWIN - EHRET - HILL, INC., with main offices in Trenton, N. J., is expected to be a strong factor in the industrial and home insulation field with five plants located in various parts of the country. Ehret Magnesia, founded in 1897, has a well established position in the industrial insulation field as a manufacturer of 85% magnesia and calcium silicate high temperature insulations. Founded in 1935, Baldwin-Hill manufactures a complete line of mineral wool thermal insulations and acoustical products. It recently introduced rigid polyurethane foam pipe insulation for low temperature use. Together, the merged company can supply, from its own plants, insulation products covering a

NEED A PROCESS FAN?



READILY AVAILABLE:

WESTINGHOUSE RUGGED, VERSATILE FANS for handling air, gas, fumes, vapors in industrial processes . . . also in a variety of types for ventilation and materials handling.

Call your nearest Sturtevant Division Sales Engineer—or write Westinghouse Electric Corporation, Hyde Park, Boston 36, Massachusetts.

J-80681

YOU CAN BE SURE...IF IT'S
Westinghouse

Plants at Hyde Park, Massachusetts; LaSalle, Illinois; Berkeley, California.

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

temperature range from 450 deg. below zero Fahrenheit to 2,000 deg. above. . .

The first 3-ton residential gas air conditioner manufactured by BRYANT MANUFACTURING CO., Indianapolis, Ind., came off the production line May 13th in a ceremony attended by many of the company's top executives and engineers. An air-cooled absorption refrigeration machine designed for outside installation, the new unit uses ammonia and water as the refrigerant and absorbent. . .

Production of Permaglas water heaters has just been initiated at a new A. O. SMITH plant in Newark, Calif. The development is designed to enable A. O. Smith to better serve the fast-growing West coast market. Until now, Permaglas water heaters were produced only at Kankakee, Ill. . .

WALWORTH CO., New York, N. Y., has announced that it has organized a new French corporation to manufacture and sell valves for pipe-lines in France and the French colonial possessions. The new corporation is called Grove-France, S. A. . .

GIBSON REFRIGERATOR CO., Greenville, Mich., has purchased the air conditioner coil manufacturing equipment of O. A. SUTTON CORP., C. J. Gibson, Jr., president of the Hupp Corp. division, announced. Purchase price was not disclosed. The equipment, installed in Sutton's Wichita, Kan., plant will be moved to Greenville. The new production line will be in operation by fall. O. A. Sutton Corp. ceased production of air conditioners early last year. The equipment purchased by Gibson makes air conditioner evaporators and condensers. . .

Acquisition of AIR-MAZE CORP., Cleveland, Ohio, by The Rockwell-Standard Corporation of Coraopolis, Pa., has been revealed through a joint announcement by the management of the two firms.

Air-Maze is a leader in the filtration equipment field. It will operate as a subsidiary of Rockwell-Standard Corporation. . .

BARBER COLMAN

Motor Operators for control of

valves, dampers, sequencing devices and other similar applications

Barber-Colman offers a line of electric motor operators for operation of a wide variety of control mechanisms. A few applications include steam and water valves, butterfly valves, multiple ratio fuel valves, oil and gas burners, Vortex control, speed-changing screws, exhaust dampers.

FEATURES

Control Forms
Two-position, floating, proportional.

Valve Linkages
Wide variety of factory-assembled Barber-Colman motor-operated valves available. Motor operators may be used to operate other makes and types of rotary or slip-stem valves.

Output Torque Range
16 to 760 lb in.

Adjustable Timing
Optional.

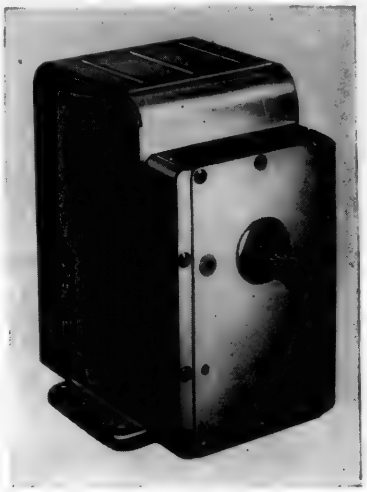
Power Requirements
24, 115, or 230-volt, a-c only.

Limits of Travel
180° standard. Other limits available.

Auxiliary Switches
Some models incorporate built-in auxiliary switch. Auxiliary switch kits available for others. Adjustable.

Output Shaft
½" or ¾" diameter, depending upon output torque.

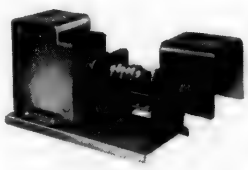
Gear Train
Precision-hobbed gears.



Typical Motor Operator

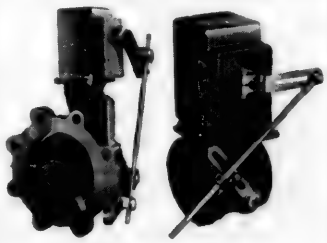
Adjustable Drive Crank
Crank arm range adjustable from ⅞" to 3⅛". Adjustable on shaft through 360°.

Oil-Submerged
Barber-Colman shaded pole induction motor and gear train sealed in oil for long life and maintenance-free operation.



Sequence Controller

Globe Valve



Butterfly Valves

Proportional Motor Operator with Integral Temperature Sensing Bulb and Control Mechanism.

Provides proportional control of temperature regulating devices—a control system in itself for many applications. Can be used on any valve assembly or controller normally furnished with Barber-Colman proportional operators. Positive positioning. Adjustable throttling range. 10 feet of armored capillary furnished as standard. Two-wire connection to any convenient 115-volt power source.

Call your Barber-Colman control office or write today, outlining your requirements.

"Better Control . . .Electrically"

BARBER-COLMAN COMPANY

Dept. T, 1302 Rock Street, Rockford, Illinois, U. S. A.

AirMpeler
LO-BOY
CENTRIFUGAL
ROOF EXHAUSTERS
Enhance The Beauty Of Building Skylines

Patt's Pond

Lowest Silhouette Design

FORWARD OR BACKWARD CURVE WHEEL WITHIN . . . . OR OUT OF SCROLL HOUSING

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- QUALITY
- BEAUTY
- PROVEN PERFORMANCE

See Sweet's File 20c/Amm or Write for bulletin AC-100-59

AMMERMAN CO., INC.
P. O. Box 182 Stillwater, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

Briefly Stated

Establishment of a Marine Department with Henry E. Cardenas as product manager, has been announced by DUNHAM-BUSH, INC., West Hartford, Conn. Mr. Cardenas will make his headquarters at the company's New York office. For five years, Mr. Cardenas was chief designer, Air Conditioning Department, Stevens & Wood, Inc., New York naval architects and marine engineers. For the past year, he has served as project engineer with the Hi-Press Air Conditioning of America.

Leon T. Mart, chairman of the board of directors of THE MARLEY COMPANY, Kansas City, Mo., died Sunday, May 17, following a heart attack. He had just returned to his home after having spent three months in California recuperating from an attack suffered while vacationing there. Mr. Mart formed the Marley organization in 1922 and was its president from that time until March 21, 1959, when he became board chairman. As an engineer and inventor in the specialized field of industrial water cooling, he gained world recognition. His books and publications in this field are accepted text books in many engineering schools. He held a number of inventions pertaining to water cooling towers and was the originator of many types of towers currently in use.

RECENT APPOINTMENTS

Appointment of J. W. Hosler as marketing manager for Kewanee and Nesbitt product lines is announced by AMERICAN-STANDARD INDUSTRIAL DIVISION, Detroit, Mich. Replacing him as air conditioning products marketing manager is R. A. Loebl, who, prior to joining American Standard's American Blower Division in 1951, had been an instructor in mechanical engineering at Norwich University and the University of Notre Dame. H. C. Grubb is appointed product manager for centrifugal refrigeration compressors, replacing Mr. Loebl. . .

As part of a major sales realignment, Thomas B. Mansfield and

Dwyer
CONTROLS GAGES
AIR VELOCITY METER
No. 400

One Instrument Tells Both Air Velocity and Static Pressure!

- Reads directly in feet per minute and inches of water.
- Check *all* velocities from 400 to 10,000 F.P.M.
- All static pressures from 0 to 10" of water.

Tests fan and blower discharge and inlet pressures, pressure drop across filters, balances air conditioning systems, etc. Complete kit includes dual purpose manometer, 18" stainless steel pitot tube, Magneclip mounting panel and all necessary fittings, tubings, instructions and accessories.

Write today for literature and prices.

F. W. DWYER MFG. CO.
P.O. Box 373-N Michigan City, Ind.

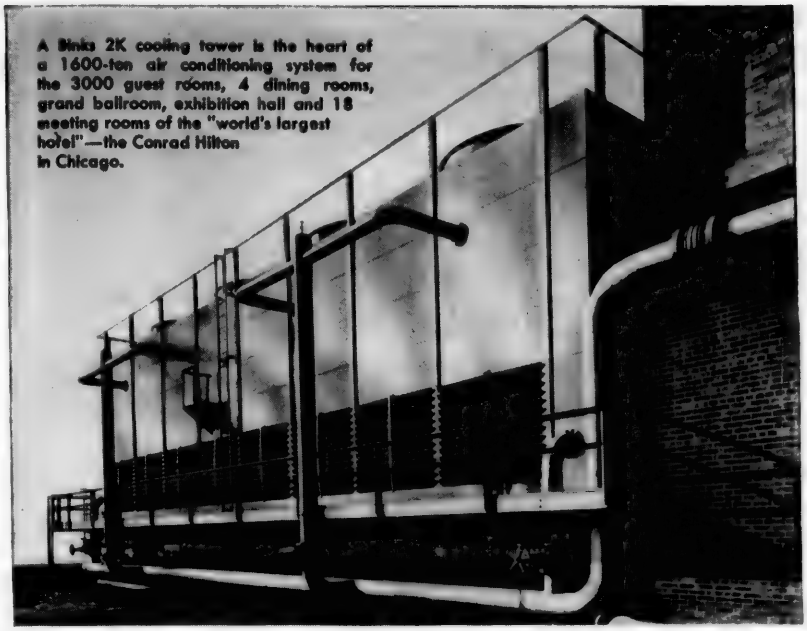
Richard D. Pennstrom have been named regional managers for the CLEAVER-BROOKS COMPANY, H. F. Holtz, sales manager, announced. Holtz said the appointments complete a program of selecting and training regional managers to administer the sale of the firm's packaged boiler products. He said the company has designated five regional managers in recent months to cope with agent expansion and sales growth. Ten years ago the company had twenty agents. Today it has over 60. . .

Walter A. Roeder is named regional sales manager for PLUMBING PRODUCTS DIV., ZURN INDUSTRIES, INC. From his Philadelphia headquarters, he will supervise the sale and service of engineered plumbing controls throughout Eastern Pennsylvania, Southern New Jersey and Delaware. He will also direct the activities of the newly-opened, fully-stocked east coast Zurn warehouse which is located at the same Philadelphia address. . .

John D. Tassan has been appointed territorial manager for northern California by TUCK-AIRE FURNACE CO., San Francisco, Calif. He has been active in the sheet metal and heating business for 12 years, holding both sales and management positions at the wholesale level with various firms. . .

Appointment of Keith T. Davis as manager of gas air conditioning for Bryant has been announced. Mr. Davis comes to Bryant from Syracuse where he was assistant to the senior vice-president of Carrier. Prior to that assignment, he held important engineering and executive posts with Affiliated Gas Equipment, Inc., which merged with Carrier in 1955. . .

FRICK COMPANY, Waynesboro, Pa., announced the appointment of David J. Wood as an assistant sales manager. His efforts will be primarily devoted to the resale of equipment through franchised connections such as distributors, air conditioning contractors, and dealers. In the twenty-one years since graduation from engineering school,



A Binks 2K cooling tower is the heart of a 1600-ton air conditioning system for the 3000 guest rooms, 4 dining rooms, grand ballroom, exhibition hall and 18 meeting rooms of the "world's largest hotel"—the Conrad Hilton in Chicago.

CONRAD HILTON HOTEL, CHICAGO

Saves $75,000 a year on water with Binks 2K cooling tower

"In 1956 we installed a Binks 2K cooling tower. It is more than paying its own way," reports Mr. H. M. Toombs, chief engineer for the Conrad Hilton Hotel, Chicago.

Only 5% daily make-up

"On a one-pass basis our 1600 ton air conditioning system would use six million gallons of cooling water daily. Instead we recycle 8600 gallons and our actual consumption is about 430 gallons daily through evaporation or drift. The efficiently balanced air-to-water ratios and counter air-water flow lowers entering water from 95° F to 85° F before it is returned to the condenser."

Maintenance savings

"In addition to water savings, the corrosion-resistant features of the Binks 2K tower will provide substantial savings in maintenance, also. The structural framing is hot-dipped galvanized after forming. Casing sheets of 16 gauge steel are also heavily galvanized and the four 120-ft. fans are of aluminum alloy."

Big job or small—call Binks

Binks towers offer you complete selection flexibility for every air conditioning or industrial process cooling need. Bulletins 333 and 477A describe these towers. Ask your Binks Branch Office for a copy. There is no obligation.

9093

Binks

EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company

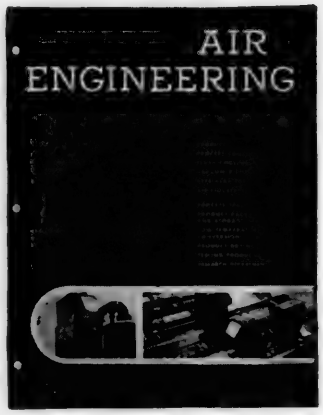
3120-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

AIR ENGINEERING by NIAGARA

- AIR CONDITIONING with precise regulation of air temperature and air moisture for processing, for product drying, packing, storing, low temperature conversion, for testing and research.
- "NO FROST" REFRIGERATION for food and low temperature conversion, for testing and operations at extreme low temperatures; for moisture control below the freezing point of water.
- AFTER COOLING and air drying for large air and gas compressors and AIR LIQUEFACTION.
- COOLING ENGINES, COMPRESSORS, HYDRAULIC PRESSES.
- COOLING QUENCH BATHS, FURNACES, INERT ATMOSPHERES.
- COOLING ROLLS, WELDERS, DRAWING OR EXTRUSION DIES.
- PRODUCT AND PROCESS COOLING CHEMICALS OR INTERMEDIATES.
- COOLING LIQUIDS OR GASES IN CLOSED SYSTEMS.
- VAPOR CONDENSING UNDER VACUUM.
- REFRIGERANT CONDENSING.
- ELECTRONIC PROCESS COOLING.

You will reduce your costs, solve your problems of water supply or disposal and get HIGH OPERATIONAL EFFICIENCY with Niagara "Aero"



Write for this Bulletin No. 135

Evaporative Heat Exchangers, After Coolers, Condensers, Air Conditioners or Coolers for these important plant services or processes.

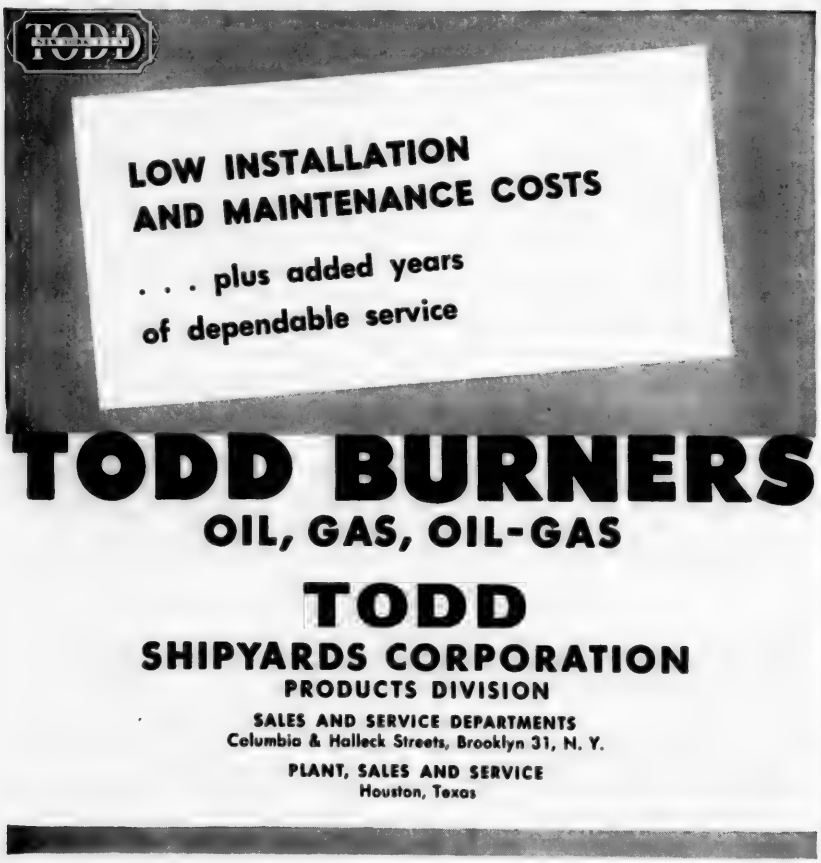
High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity. It means the lowest expense for up-keep.

Write for Bulletin 135

NIAGARA BLOWER COMPANY

Dept. HV-8, 405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada



TODD BURNERS

OIL, GAS, OIL-GAS

TODD

SHIPYARDS CORPORATION

PRODUCTS DIVISION

SALES AND SERVICE DEPARTMENTS
Columbia & Halleck Streets, Brooklyn 31, N. Y.

PLANT, SALES AND SERVICE
Houston, Texas

Briefly Stated

Mr. Wood, with one of the larger manufacturers of the industry, has engineered and sold all sizes of refrigerating and air conditioning machinery and apparatus. . .

THE IMPERIAL BRASS MFG. CO., Chicago, Ill., has announced the election of three new vice presidents: Gordon J. Duerr, for marketing; George E. Franck, for engineering and research; and Fred W. Winter, for manufacturing. All three offices represent newly created posts in the organization. Mr. Franck has been the company's director of engineering and has many patents to his credit on fuel system, hydraulic and instrumentation components. . .

Charley Lockhart, of Dallas, a veteran of over twenty years in the gas air conditioning and heating field, has been appointed as associate for water chiller equipment in the state of Texas by ARKLA AIR CONDITIONING CORP. Mr. Lockhart's primary responsibility will be the development of Texas distribution and markets for the Arkla-Servel line of 25-ton steam-operated water chillers, according to the company, whose general sales offices are located in Little Rock, Ark. . . .

John J. Freeman is recently appointed vice-president and general manager for MAGNETROL, INC., Chicago, Ill. Most recently associated with International Register Co., Chicago, Mr. Freeman is a graduate of Yale University with a B.S. degree in Industrial Administration and Engineering, and has a MBA degree from Harvard Business School, where he was a Baker Scholar. . . .

Clancy W. Pollock has been appointed sales manager for the air conditioning products of NATIONAL-U. S. RADIATOR CORP., Johnstown, Pa. He was manager of sales and engineering of the company's Drayer-Hanson Division, Los Angeles. Mr. Pollock is a registered professional engineer in the state of California and an ASHRAE member. . . .

(Concluded on page 144)

NEW!

SIL-rayvector
RADIATION

"Custom fits" without cutting . . . Slashes installation time & expense

Standardized sections up to 4' lengths. Accessories for unusual building contours. Finned tubes mounted and adjusted to required pitch in seconds on sliding cradle hangers. Elements packaged individually for easy handling. Write, wire or phone for complete catalog.

radiant-ray BRAND

radiant-ray radiation, inc.
newington, connecticut

PROVED ON THOUSANDS OF PRODUCTION LINE INSTALLATIONS!

"250" SERIES
LIQUID EYE®
POSITIVE SEALING INDICATORS
designed to save you *even more* time and money

DESIGN FEATURE
extension-gasket . . .
ALL ONE-PIECE!
A built-in gasket that's always in place for positive sealing and foolproof assembly.

6 sizes now available: ⅜", ½", ⅝", ¾", 1⅛" and 1⅜" O.D.S.

The "250" has all the proved Liquid Eye advantages *plus* these newly engineered features:

- smaller—more compact, simplified design.
- preformed copper extension eliminates need for separate gaskets—*foolproof* installation.
- complete, self-contained, economy unit.

Write today for catalog E-57 covering the complete Allin line.

Allin
ALLIN MANUFACTURING CO.
410 N. Hermitage Ave. • Chicago 22, Illinois
Over 1,000,000 Liquid Eyes Sold to Date!

INSTALLING WALL-HUNG FIXTURES

SPECIFY SMITH LONG BARREL

ADJUSTABLE FITTINGS & CHAIR CARRIERS

Make the Job PLUMB-EASY

CUT COST
SAVE TIME, LABOR, MATERIAL

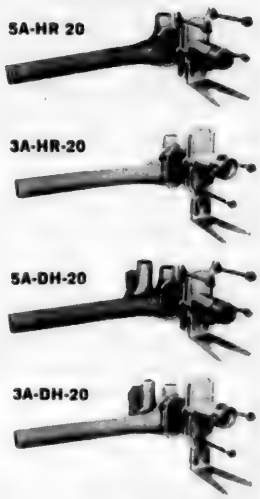
On horizontal battery runs, the new Jay R. Smith Caulked Long Barrel Fittings make Wall-Hung Fixture installations "PLUMB-EASY."

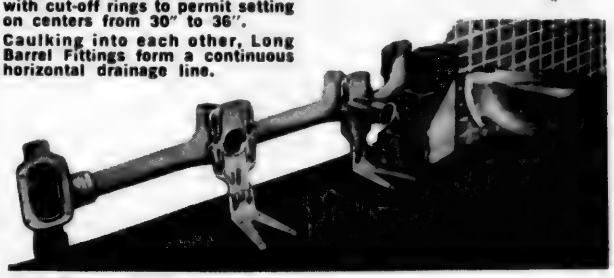
Providing an extra long spigot, Long Barrel Fittings permit caulked carrier fittings to be installed on 36" (or less) centers without requiring additional piping, and eliminating the caulking of extra joints.

Saving time, labor, and material, Smith Long Barrel Fittings cut cost and make a stronger, neater installation.

Long Barrel Fittings are furnished with cut-off rings to permit setting on centers from 30" to 36".

Caulking into each other, Long Barrel Fittings form a continuous horizontal drainage line.





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Union New Jersey
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"OG" SERIES
INDUSTRIAL HEATER

Remarkable Adaptability

Efficient heat transfer design results in reduced physical size of this heater . . . allowing it to take up a minimum of space. If floor space is at a premium, the "OG" can be suspended horizontally or inverted. Removable nozzles permit free-standing or ducted installations.

DUAL FUEL
Power Burners

Burner operates equally well with either gas or oil. Change-over is instant and automatic.

LENNOX "Task-Matched" Equipment to control and condition air for industry

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Des Moines 5, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters

Name.....
Company.....
Address.....City.....
Title.....

Briefly Stated

(Concluded from page 142)

J. Wayne Lindquist has been appointed manager of National Tube standard pipe products, according to an announcement by U. S. STEEL'S NATIONAL TUBE DIVISION. . .

BURNHAM CORP., Irvington, N. Y., Steel Boiler Department, announces the appointment of William C. Wetherstine, Jr. as sales representative in the Philadelphia, eastern Pennsylvania, southern New Jersey and Delaware territory. Mr. Wetherstine has been active in the sale of steel boilers for over twenty years. He will promote and sell the Burnham line of Compact-type, Scotch-type and Scotch-type packaged low pressure heating boilers. . . .

I. Newton Becker, executive vice-president of AMERICAN MACHINE AND METALS, INC., has been elected to the company's board of directors. Mr. Becker joined American Machine and Metals in 1929 as a divisional sales manager and held several sales posts until 1947 when he was elected vice-president and general manager of the company's United States Gauge Division. In 1957 he was named vice-president in charge of operations for the parent company and has been executive vice-president for the past year. . .

Samuel F. Shawhan, president of Bryant Manufacturing Company, completed 30 years of service with Carrier, of which Bryant is an operating division. In February, he marked the anniversary of his first year as president of Bryant, producer of heating and air conditioning equipment, with headquarters in Indianapolis. Before becoming president of Bryant, Mr. Shawhan was assistant to the president of Carrier since 1955. His career with Carrier included important work on the early self-contained or "packaged" air conditioning units. Later he directed the development of residential combination heating and cooling equipment. In 1953 he became assistant general manager of Carrier Unitary Equipment Division in Syracuse.

CLASSIFIED ADVERTISING

Sold at $12 per column inch.

SALES REPRESENTATIVES

Leading manufacturer of industrial ventilation equipment offers attractive proposition to qualified representatives in San Francisco, Louisville and Charleston, W. Va. areas. Established, fast-moving organization. Excellent products lines backed by national advertising. Good commission set-up. Box 948, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

If you have a BSME degree or its equivalent in experience; if you have a good personality and you like people; if you have had a few years of good work experience in the event you did not attend college; and if you are interested in temperature controls — A GROWING MID WEST INDUSTRY WOULD LIKE TO HEAR FROM YOU!

Please contact Box 945, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

LINE WANTED

Registered Professional Engineers, E. E. & M. E. Sales Engineers, engaged since 1910 in selling power plant equipment. We are looking for a line of cast iron boilers, fire box boilers, and a complete line of motor driven pumps. Write Box 946, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

MECHANICAL ENGINEERS

With 3 or more years experience in mechanical design for buildings, including heating, air-conditioning, plumbing, etc. Permanent employment with well-established midwestern consulting engineering firm. Write Box 947, Air Conditioning, Heating and Ventilating, 93 Worth St., New York 13, N. Y., giving personal resume and required salary.

MANUFACTURERS' AGENTS

An established manufacturer with 25 years experience producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans. The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators.
Please reply Box 914, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

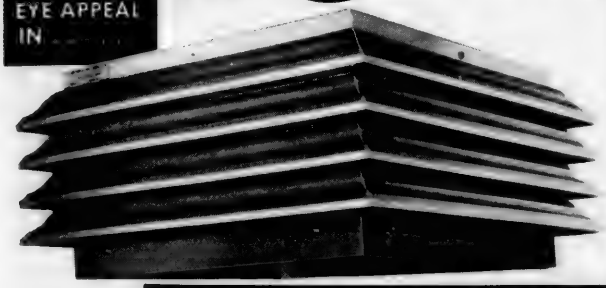
The Essential Selling Force

This supremely valuable document is FREE to businessmen who want to **reduce** their advertising **costs**, and **create** advertising **profits**. It's power-packed! No obligation. J. E. Smith, 2250 N. Mason, Chicago 39, Illinois.

PRINTED FORMS available for immediate shipment. Heating & oil burner materials form, burner service record cards, service order forms, inspection information form, survey sheet and others. Also can supply BURNER SERVICE form in 8 part EZE-SNAP with 3 cartons in each set, 1200 sets Imprinted with your name, address and telephone, only $20.40. Send for samples—no obligation. Write Dept. AC, Degree Day Systems, 39-30 58th St., Woodside 77, N. Y.

ALL FUNCTIONAL FEATURES PLUS EYE APPEAL IN

Low Silhouette



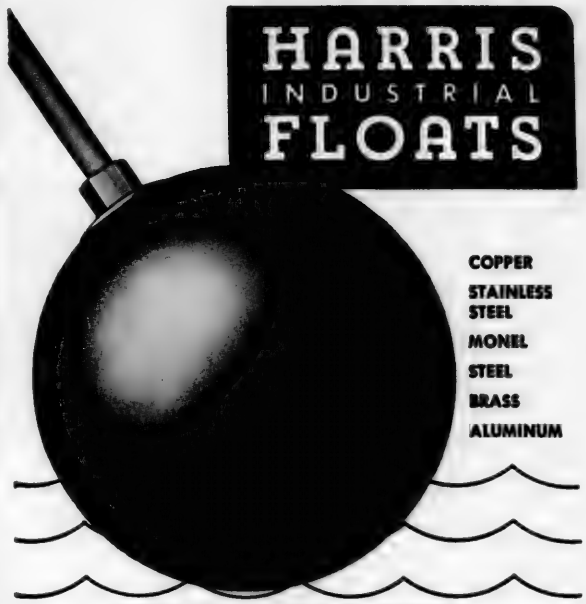
WAUSAU AIR MOVER

- **MODERN DESIGN** — Aluminum Extrusions designed to permit low outlet velocities . . . housing completely weatherproof.
- **NO UNSIGHTLY CURB MOUNTINGS** — Point of Discharge used in design makes unsightly curb mountings unnecessary.
- **MORE RIGID WHEEL SUSPENSION** — Unique bearing arrangement places fan wheel center of gravity between the bearings provided, more rigid wheel suspension system . . . bearing well also adds rigidity.
- **NO INLET OBSTRUCTIONS** — Air stream is free of all braces, cross members and other obstructions which produce turbulence and noise.
- **EASY ACCESS FOR SERVICING AND LUBRICATING** Bearings are accessible for easy lubricating. Bearings designed for belt drive application; totally enclosed designed for long life . . . motor (ball bearing motor and explosion proof also available).

Write for new catalog, complete details and specifications.

GREENHECK FAN & VENTILATOR CORP.
SCHOFIELD • WISCONSIN

HARRIS INDUSTRIAL FLOATS



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STAINLESS STEEL
MONEL
STEEL
BRASS
ALUMINUM

Built for open or closed tank operation at low or high pressures and temperatures.

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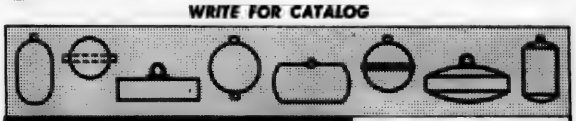
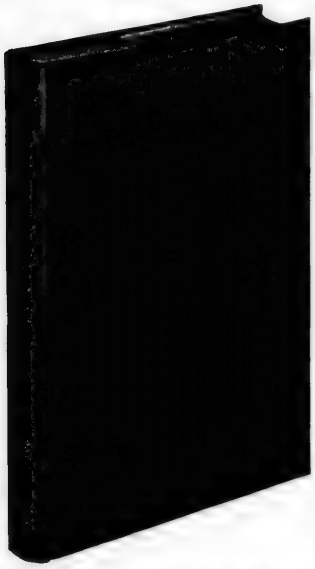


ARTHUR HARRIS & CO.
Established 1874
20 N. Aberdeen St. Chicago, Ill.

Solve Heat Transfer Problems Directly and Accurately!



336 Pages, 136 Charts and Illustrations

$7.00

INDUSTRIAL HEAT TRANSFER by F. W. Hutchinson, presents 123 working graphs that permit the direct solution of complex problems of heat transfer. Use of these graphs — which are equal in accuracy to the equations from which they are derived — speeds heat transfer analysis and helps to eliminate errors in calculation. In addition to the complete text, graphs are provided for: air, acetylene, ammonia, benzene, chlorine, ethane, ether, helium, oxygen, pentane, steam, sulphur dioxide, water, and 57 other industrially used liquids and gases.

Get your copy of this valuable working reference book today!

THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y.

PITCHER BILLY PIERCE FAILS TO FLAKE INLAND TI-CO®

We'd told Bill to go on out there and knock the spangle off that TI-CO galvanized sheet. But what we hadn't told him was that for years, sheet metal men have been punching, perforating, crimping and Pittsburgh lock-seaming TI-CO with . . . never a flaking problem!

Sure, Bill dented it. In fact TI-CO's easy formability is one of the nice characteristics of this versatile galvanized sheet. It's firm, yet soft enough to take the most complicated forming without time-and-money-wasting makeovers. Stays flat, too. When you hammer it, you can be sure it won't spring back.

We recommend this quality, zinc-coated sheet for every sheet metal application. You'll like the fact that it won't chip, peel, crack or flake, no matter how tough the requirements. We think it will give you installations you can be proud of—every time!

American League Pitcher Billy Pierce makes a close-up inspection—finds not a trace of flaking on TI-CO's zinc coating.

Ask your Steel Service Center for the TI-CO Brand...the galvanized sheet that's tailor-made for sheet metal work.

INLAND TI-CO®

AMERICAN STEEL WAREHOUSE ASS'N

INLAND STEEL COMPANY
30 West Monroe Street • Chicago 3, Illinois

ALPHABETICAL INDEX OF ADVERTISERS

A

Aerofin Corp. 9
Aerovent Fan Co., Inc. ..... *
Air Devices, Inc. ..... *
Air Filter Corp. ..... *
Air Filter Institute ..... *
Airtemp Div., Chrysler Corp. 131
Alco Valve Co. ..... *
Allen Cooler & Ventilator, Inc. 124
Allen, W. D., Mfg. Co. ..... *
Allied Chemical Corp., General Chemical Div. 13
Allin Manufacturing Co. 143
Allis-Chalmers Mfg. Co. 113
American Brass Co. 127
American Gas Association 18-19
American Machine and Metals, Inc. .. 41
American-Standard Industrial Div. ... *
Ammerman Co., Inc. 140
Anemostat Corp. of America 44
Answer America, Inc. 133
Armstrong Machine Works 1
Arno Adhesive Tapes, Inc. ..... *

B

Babbitt Steam Specialty Co. ..... *
Barber-Colman Co. 121, 139
Bell & Gossett Co. 2, 17
Bethlehem Steel Co. 32
Binks Manufacturing Co. 141
Bryan Steam Corp. ..... *
Buensod-Stacey, Inc. 15
Buffalo Forge Co. 29
Buffalo Pumps Div., Buffalo Forge Co. *
Burnham Corp. 123
Burt Manufacturing Co. 134
Byers, A. M., Co. ..... *

C

Cain Manufacturing Co., Inc. ..... *
Cambridge Filter Corp. 132
Carrier Corp. ..... *
Chicago Pump Co. ..... *
Clarage Fan Co. ..... Inside Back Cover
Classified Advertisements 144
Cleaver-Brooks Co., Boiler Div. 136
Concrete Thermal Casings, Inc. 130
Construction Specialties, Inc. ..... *
Cook, Loren, Co. ..... *
Cordley & Hayes ..... *
Coyne & Delany Co. ..... *

D

Davis Engineering Corp. 51
DeBothezat Fans Div., American Machine and Metals, Inc. 41
Dravo Corp. ..... *
Drayer-Hanson Div., National-U. S. Radiator Corp. ..... *
Dunham-Bush, Inc. 37
Dwyer, F. W., Manufacturing Co. ... 140

E

Edwards Engineering Corp. ..... *
Elgo Shutter & Mfg. Co. ..... *
Emerson Electric Mfg. Co. 30
Ewing Manufacturing Co. 137

F

Fafnir Bearing Co. 33
Field Control Div., H. D. Conkey & Co. 49
Flexaust Co. 138
Frick Company 133

G

Greenheck Fan & Ventilator Corp. ... 145
Gustin-Bacon Manufacturing Co. .... *

H

Halstead & Mitchell 111
Harris, Arthur & Co. 145
Hartzell Propeller Fan Co. 24
Henry Valve Co. ..... *
Hoffman Specialty Manufacturing Corp. 11

I

Ilg Electric Ventilating Co. 5-7
Illinois Testing Laboratories, Inc. 112
Industrial Press ..... *
Inland Steel Co. 146
International Boiler Works Co. ..... *
Iron Fireman Manufacturing Co. 129

J

Jenkins Bros. 43
Jenn-Air Products Co., Inc. 38
Johns-Manville 40
Johnson Service Co. ..... Back Cover
Joy Manufacturing Co. 48

K

Kaiser, E. B., Co. 28

L

Lawler Automatic Controls, Inc. ..... *
Lennox Industries, Inc. 144

M

Magnetrol, Inc. ..... *
Marsh Heating Equipment Co. 22
McDonnell & Miller, Inc. 25
McQuay, Inc. ..... *
Minneapolis-Honeywell Regulator Co. 116-119

N

Nash Engineering Co. 52
National Tube Div., United States Steel Corp. 50
New York Blower Co. ..... *
Niagara Blower Co. 142
Nibco, Inc. 34-35

P

Patterson-Kelley Co. 39
Peerless Electric Co. 20
Petro ..... *
Pittsburgh Plate Glass Co. 115
Powers Regulator Co. ..... *
Pratt, Henry, Co. 135
Pyle-National Co. 46

Q

Quickdraft Corp. 114

R

Radiant-Ray Radiation Inc. 143
Reading Tube Corp. 47
Research Products Corp. ..... *
Reznor Manufacturing Co. 125
Ric-Wil, Inc. 148

S

Sarcotherm Controls, Inc. 45
Skidmore Corp. 21
Smith, Jay, R., Mfg. Co. 143
Spence Engineering Co., Inc. 36
Sporlan Valve Co. 31
Spraying Systems Co. 133
Sterling, Inc. 122
Sturtevant Div., Westinghouse Electric Corp. 138
Symmons Engineering Co. 120

T

Taco Heaters, Inc. 26-27
Thermal Engineering Corp. 128
Todd Shipyards Corp. 142

U

United States Steel Corp., National Tube Div. 50

W

Wagner Electric Corp. ..... *
Waterloo Register Co., Inc. ..... *
Watts Regulator Co. ...Inside Front Cover
Webster Electric Co. 137
Webster Engineering Co. ..... *
Weil-McLain Co. 42
Weil Pump Co. ..... *
Weirton Steel Co., Div., National Steel Corp. 23
Weksler Instruments Corp. ..... *
Western Engrg. & Mfg. Co. 126
Westinghouse Electric Corp., Sturtevant Div. 138
Wiremold Co. ..... *

Y

Yarnall-Waring Co. ..... *

*Advertiser appeared in preceding issue

at Award Winning Linton High School...

RIC-WIL
was specified and installed for the underground piping system

Architects: Perkins and Will; Ryder & Link
Consulting Engineer: E. R. Gritschke
Contractor: Tougher Plumbing & Heating Co.

RIC-WIL is indeed proud to be a part of the Linton High School Project. All of the firms participating in the annual awards are to be congratulated and encouraged in promoting better design of educational buildings. For over 49 years RIC-WIL has supplied the distribution piping systems for educational buildings through the United States, Canada and many foreign countries. These piping systems have proved to be the finest in Thermal efficiency and mechanical strength. Complete information is available on the many types of systems. Write, wire or phone for literature.

See our catalog in Sweets

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency
SINCE 1910

RIC-WIL PREFABRICATED INSULATED PIPING SYSTEMS

CENTRAL OFFICE: RIC-WIL INCORPORATED, BARBERTON, OHIO
WESTERN STATES: WESTERN RIC-WIL COMPANY, NEWARK, CALIF.
IN CANADA: THE RIC-WIL COMPANY OF CANADA LIMITED

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

PRESSURE RELIEF PROTECTION ..... for hot water boilers has its most advanced design in the ASME-rated double-safe valves manufactured by Watts Regulator Co. Bulletin is available.
Inside Front Cover — Item 200

INVERTED BUCKET STEAM TRAPS .... from Armstrong are designed and made to give you these big benefits: No steam loss, automatic air elimination and big capacity in small package. Steam trap book is offered.
Page 1 — Item 201

A NEW COMPRESSOR ..... to meet today's requirements is offered by Bell & Gossett Co. Units are quiet and vibrationless. A complete file of specifications and application data on the company's equipment is available.
Page 2 — Item 202

ELECTRIC HEATING JOBS ..... can be simple if you "write in" electric units manufactured by Ilg. Units include radiant baseboard, wall insert heaters, and cabinet heaters. Electric Heat Manual is offered.
Pages 5-7 — Item 203

"AIRY" DOWNTOWN PLAN ..... of Detroit finds an outstanding example in the National Bank of Detroit. Bank utilizes Aerofin coils for ample heat exchange capacity in limited space. Information is available.
Page 9 — Item 204

STEAM SPECIALTIES ..... are available in a complete quality line from Hoffman Specialty Manufacturing Corp. for industrial, institutional and residential steam heating systems. Literature is offered.
Page 11 — Item 205

REFRIGERANT CYLINDER CARRIER ... doubles as a charging stand. It is offered during July and August with the purchase of 22 lb or more of Genetron refrigerants. Information is available.
Page 13 — Item 206

AIR MIXING UNITS ..... with automatic volume regulators, from Buensod-Stacey, eliminate the bottleneck of on-the-job adjustment of volume in dual-duct high velocity installations. Information is available.
Page 15 — Item 207

CIRCULATING PUMPS ..... built by Bell & Gossett for institutional, commercial or residential jobs are engineered to meet the demands of water heating and cooling systems dependably, smoothly and quietly. Information is offered.
Page 17 — Item 208

AIRPORT COOLING SYSTEM ..... which is the world's largest uses gas-operated Carrier absorption refrigeration. Seasonally idle boilers are put on year-round paying basis. Information is available.
Pages 18-19 — Item 209

FAN AND BLOWER WHEELS ..... at Peerless Electric must balance electronically perfect before they are installed in their scrolls, no matter what the size. Catalogs are offered.
Page 20 — Item 210

HEATING PUMPS ..... are offered in a complete line by Skidmore Corp. There is a type and capacity for every general or special installation. New vertical pump features close-coupled design and mechanical shaft-seal. Bulletins available.
Page 21 — Item 211

PACKLESS RADIATOR VALVES ..... are but part of the extensive line of heating specialties offered by Marsh Heating Equipment Co. Other products include traps, gages, and thermometers. Catalog is available.
Page 22 — Item 212

INSTANT STEEL ..... is a product of Wierton Steel Co. A call to your local steel distributor ends inplant shortages fast. Information is offered.
Page 23 — Item 213

POOR VENTILATION ..... can lead to product rejects; Hartzell ventilation can help prevent it. The company's complete line includes the fan, blower or ventilator that's right for your job. Information is available.
Page 24 — Item 214

DATA ON SAFETY CONTROLS ..... and operating controls for jobs involving liquid level or liquid flow are given in new 24-page engineering reference bulletin which is offered by McDonnell & Miller, Inc.
Page 25 — Item 215

CENTRIFUGAL PUMP SELECTION ..... is simplified with Taco's new LP Series. You get the specific centrifugal pump to match required performance. Pump catalog, with quick selection charts, is available.
Pages 26-27 — Item 216

UNDERGROUND SYSTEMS ..... for heat distribution are a specialty of E. B. Kaiser Co. Hints on specifying Ebko piping systems are detailed in advertisement. A 24-page catalog for designing and specifying underground heat distribution systems is offered.
Page 28 — Item 217

NEW AIR-COOLED CONDENSERS ..... from Buffalo Forge Co. offer trouble-free operation. They are a sound engineering choice for your problem air conditioning installations. Information is available.
Page 29 — Item 218

MOTOR DRIVE PROBLEMS ..... for appliances or equipment get instant service from power-drive specialists at Emerson Electric. Custom engineered motors suit your specific needs. Information is available.
Page 30 — Item 219

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

REFRIGERANT DISTRIBUTORS ..... with versatile interchangeable nozzle give controlled distribution to every circuit every time. Sporlan Valve Co. offers bulletin.
Page 31 Item 220

EVEN THE BEARINGS ..... are built for comfort in Westinghouse Comfort Command air conditioners. Bearings on blower shaft feature balls and races especially polished for noiseless service. Bulletin is offered by Fafnir Bearing Co.
Page 33 Item 221

COPPER FITTINGS ..... from Nibco are strong where it counts. These fittings are stronger than the tube they join. Catalog is available.
Page 34 Item 222

WELDING FITTINGS ..... from Nibco conform in all respects to the high standards set forth by the American Society for Testing Materials. Catalog is offered.
Page 35 Item 223

WHEN REGULATORS DEVELOP ..... trouble, engineers want to get them back on the line quickly. That's one reason why more engineers are standardizing on Spence regulating valves with externally mounted pilots. Bulletin is offered.
Page 36 Item 224

FOR NEW AIR CONDITIONING ..... systems or for bringing your present system up to date give your problem to a Dunham-Bush sales engineer. This was done at American Thread Co. Information is available.
Page 37 Item 225

POWER ROOF EXHAUSTERS ..... with large air moving capacity, and all-aluminum low-contour relief vents are available from Jenn-Air Products Co Literature is offered.
Page 38 Item 226

STORAGE WATER HEATER ..... in New York's Bronx County building has processed, in 27 years, 8½ million gallons of rust-free hot water at 140 deg F. Other copper lined heaters from Patterson-Kelley Co. will provide long maintenance-free operation for you. Data file is available.
Page 39 Item 227

ASBESTOS-CEMENT PIPE BOOKLET ... offered by Johns-Manville contains 24 pages. Describes the layout and installation economies, wide variety of fittings, diameters, and lengths, its adaptability to venting service. Never needs painting, easily cut, resists most gases, fumes, and dusts.
Page 40 Item 228

INDUCED DRAFT FANS ..... from DeBothezat are used where dependability counts. They are used in unattended radio relay towers at the American Telephone and Telegraph Co. Catalog is offered.
Page 41 Item 229

BOILER-BURNER UNITS ..... from Weil-McLain Co. burn No. 5 oil or combination gas-light oil. Cast iron units range from 3,395 to 12,260 sq ft of steam. Bulletin is offered.
Page 42 Item 230

VALVE DATA ..... including selection and application information, are offered in 296-page general catalog published by Jenkins Bros. A copy is available by writing on your letterhead to the company, instead of using the inquiry card.
Page 43 Item 231

DRAFTLESS AIR DIFFUSERS ..... from Anemostat supply conditioned air at the Sterling & Francine Clark Art Institute in Williamstown, Mass. Selection manual for air diffusion equipment is offered.
Page 44 Item 232

AIR-LIGHT TROFFER ..... offered by Multi-Vent provides both air and light from the same unit. The air diffuser is completely concealed in the flush light fixture. Provides draft-free air conditioning with highly efficient lighting at substantial cost savings. Detailed literature available.
Page 46 Item 233

COPPER TUBING LINE ..... available from Reading Tube includes: Lektroneal copper tube; Lektroseal copper refrigeration tube; Readi-Fin finned copper tube; and Mackenzie Walton precision copper tube. Also commercial copper tube, red brass and copper pipe. Information is available.
Page 47 Item 234

CONTROLLABLE PITCH ..... on Joy Axivane fans permit automatic adjustment of air supply to carbon dioxide concentration, temperature or humidity. Bulletin is offered.
Page 48 Item 235

THE CONTROL OF DRAFT ..... is fully covered in technical brochures which are available from Field Control. A specification guide and a handbook and installation guide are offered.
Page 49 Item 236

STEEL PIPE ..... from National Tube is used for heating and air conditioning at Houston office of the Prudential Insurance Company of America. Seamless or butt-welded pipe pays you back in outstanding service a hundred times over for every dollar you spend for it. Information available.
Page 50 Item 237

FUEL OIL HEATER ..... from Davis Engineering permits direct use of boiler water and fuel oil in the same shell without danger of system contamination. Bulletin is offered.
Page 51 Item 238

QUIET AIR-COOLED CONDENSERS .... offered by Halstead & Mitchell have had fan noise, vibration, and rattling engineered out of them. Deep pitch fans are run at slow speeds. Casings are rugged and will not loosen with use. Provision for winter operation and multiple circuiting. Information is available.
Page 111 Item 239

DIRECT READING VELOMETER ..... measures actual air delivery. Simple, direct reading gives instant measurement in any distribution system. Alnor velometer is portable, easy to understand and to use. Bulletin is available.
Page 112 Item 240

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. All advertisements are digested here except those that are received too late for inclusion in this listing.

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

MOTOR STARTERS ..... for air conditioning service offer rugged simplicity. Simple, durable contactors assure continuous service. Information is available.
Page 113 Item 241

POWER DRAFT UNIT ..... for industrial, residential, and institutional exhausting, is available from Quickdraft. Increases heating and combustion efficiency, provides air power for bulk materials handling, and exhausts corrosive gases and abrasives.. No motors, fans or bearings in exhaust lines. Engineering data offered.
Page 114 Item 242

FIBER GLASS INSULATION ..... is an excellent acoustical and thermal lining for sheet metal ducts, and is made by Pittsburgh Plate Glass. Withstands air velocities, has proven erosion resistance, and is easy to work on the job. Information is available.
Page 115 Item 243

PNEUMATIC VALVES ..... from Minneapolis-Honeywell give you superior characteristics, sharply up-graded ratings. There is a pneumatic valve to exactly match your application. Information is available.
Insert bet. 116-120 Item 244

ELECTRONIC AIR CLEANER ..... from Minneapolis-Honeywell offers flutter-jet washing. It removes 95% of all airborne dirt. Information is offered.
Insert bet. 116-120 Item 245

COMBINATION VALVE ..... for tub and shower is offered by Symmons Engineering Co. It provides full flow and temperature control with only one moving part. Bulletin available gives all details.
Page 120 Item 246

AIR TURNING DEVICES ..... may be evaluated with facts contained in this ad by Barber-Colman Co. When design, cost, installation and performance are considered, you'll consider the company's Airturns. Literature is offered.
Page 121 Item 247

CONDENSATE PUMP ..... from Sterling, Inc., is designed specifically for small installations, yet adequate for jobs up to 3000 sq ft EDR. It allows accurate adjustment, is exceptionally quiet and dependable. Information is available.
Page 122 Item 248

TWO SCOTCH-TYPE BOILERS ..... of the largest size that can be built as a single unit for transportation are being used in "The Dream School of the East." Information on Burnham steel boilers is available.
Page 123 Item 249

ROOF VENTILATION LINE ..... from Allen Cooler & Ventilator, Inc., meets all requirements efficiently and economically. Low contour units, high velocity units, wind-driven turbines, and exhaust fans. Catalog is available.
Page 124 Item 250

STAINLESS STEEL DUCT FURNACES .. from Reznor are demanded by tough buyers because the heat exchanger and burners cannot corrode. Information is available.
Page 125 Item 251

ROTARY ROOF VENTILATORS ..... from Western Engineering & Mfg. Co. have lifetime guaranteed bearings. High, constant exhaust capacity is assured. Catalog is available.
Page 126 Item 252

ALL-COPPER PLUMBING ..... utilizing Anaconda copper tube and fitting was chosen for new Butte, Montana, hospital because it cost no more, saved space and offered economies in maintenance. Information is available.
Page 127 Item 253

AIR-CONDITIONING EQUIPMENT ..... from Thermal Engineering Corp. helps keep pilots cool in the flight simulator building of Eastern Airlines in Miami. Information is available.
Page 128 Item 254

BURNER FOR MEDIUM BOILERS ..... produced by Iron Fireman has all the advantages of big burners but needs no more supervision than domestic units. Information and specifications on the WhirlBlast burner are offered.
Page 129 Item 255

UNDERGROUND PIPE INSULATION ... is available from Concrete Thermal Casings, Inc. Includes cased thermal concrete for jobs in which water is expected to be over the conduit, Z-crete, for jobs in which water may be over the conduit periodically, and b-t-u, for jobs in which rain or irrigation water may stand over conduit occasionally. Bulletin helps choose system, lists certified contractors.
Page 130 Item 256

ALL-WEATHER CONTROL ..... assures ideal indoor Climate by Chrysler all year long, regardless of outdoor temperature. Usually optional features are standard equipment. Information is available.
Page 131 Item 257

THE RELIABLE FILTER ..... manufactured by Cambridge Filter Corp. offers high efficiency positive filtration, low pressure drop, easy installation and maintenance. Company offers expert technical assistance. Bulletin is available.
Page 132 Item 258

NATIONWIDE ANSWERING SERVICE .. offers to answer your emergency calls, dispatch and route your service men 24 hours a day. Service is called Answer America, Inc. Information is available.
Page 133 Item 259

SHELL VESSELS ..... from Frick Co. can be provided to fill all your needs. Company has 106 years' experience in building pressure vessels from boilers to reactors. Information is available.
Page 133 Item 260

SPRAY NOZZLES ..... for evaporative roof cooling are manufactured by Spraying Systems Co. They reduce indoor temperatures on hot sunny days from 10 to 20 degrees. Bulletin is offered.
Page 133 Item 261

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, for further information from manufacturers.

FREE EXHAUST .....
fan ventilators rout heat and fumes fast in True Temper's new Saybrook Forge plant. Burt's complete line of modern roof ventilators is described in databook which is available.
Page 134 Item 262

RUBBER SEAT BUTTERFLY VALVE .....
from Henry Pratt Co., is a versatile valve with a wide variety of sizes, materials and operators. Bulletin is offered.
Page 135 Item 263

BOILER STARTING SERVICE .....
offered by Cleaver-Brooks assures tip-top boiler performance and greater customer satisfaction. All units fully factory tested, ready to install on job sites; 80% efficiency guaranteed. Information is available.
Page 136 Item 264

HOT WATER HEATER .....
of the automatic, commercial type is offered by Ewing Mfg. Co. It is called the low cost answer to the hot water problem for laundries, restaurants, motels, schools and apartments. Information is available.
Page 137 Item 265

FUEL OIL HANDLING .....
equipment from Webster Electric provides a complete line for all commercial and industrial applications from tank to burner. Three bulletins are offered.
Page 137 Item 266

VERSATILE FANS .....
for handling air, gas fumes and vapors in industrial processes are available from Westinghouse. Information is offered.
Page 138 Item 267

FLEXIBLE HOSE .....
from The Flexaust Co. is adaptable for all kinds of fume and dust control and ventilation uses. It is durable, lightweight, and easy to install. Details are available.
Page 138 Item 268

ELECTRIC MOTOR OPERATORS .....
for control of valves, dampers, sequencing devices and other similar applications are offered by Barber-Colman. Information is available.
Page 139 Item 269

CENTRIFUGAL ROOF EXHAUSTERS ...
of lowest silhouette design by Ammerman enhance the beauty of building skylines. Forward or backward curved wheels within or out of scroll housing. Certified cfm ratings. Bulletin is available.
Page 140 Item 270

AIR VELOCITY METER .....
is a single instrument which tells both air velocity and static pressure. Reads directly in feet per minute and inches of water, checks all velocities from 400 to 10,000 fpm, reads static pressures from 0 to 10 inches of water. Literature and prices available from F. W. Dwyer.
Page 140 Item 271

COOLING TOWER SAVES WATER .....
to the tune of $75,000 a year for Conrad Hilton Hotel in Chicago. Installed in 1956, chief engineer attests that it is paying its own way. Bulletins describe Binks tower line.
Page 141 Item 272

OIL BURNERS .....
plus burners for gas and oil-gas are offered by Todd Shipyards Corp. They have low installation and maintenance cost, yet many years of dependable service. Information is available.
Page 142 Item 273

AIR ENGINEERING BOOKLET .....
offered by Niagara Blower Co. whose systems give precise regulation of air temperature and moisture. Components include evaporative heat exchangers, after coolers, condensers, air conditioners, and coolers.
Page 142 Item 274

FOR WALL-HUNG FIXTURE .....
installations, Jay R. Smith Mfg. Co. recommends its long barrel adjustable fittings and chair carriers. They save time, labor and material. Information is available.
Page 143 Item 275

FINNED TUBE RADIATION .....
from Radiant-Ray "custom fits" without cutting, slashes installation times and expense. Catalog is offered.
Page 143 Item 276

POSITIVE SEALING INDICATORS .....
made by Allin Mfg. Co. proven on thousands of production line installations have one piece extension gasket for positive sealing and fool-proof assembly. Six sizes. Complete line catalog available.
Page 143 Item 277

INDUSTRIAL HEATER .....
has remarkable adaptability. Lennox Series OG units have efficient heat transfer design resulting in reduced physical heater size. Dual fuel power burners. Spec sheets are offered.
Page 144 Item 278

INDUSTRIAL FLOATS .....
from Arthur Harris & Co. are offered in copper, stainless steel, monel, steel, brass and aluminum. They are built for open or closed tank operation at low or high pressures and temperatures. Catalog is available.
Page 145 Item 279

LOW SILHOUETTE AIR MOVER .....
announced by Greenheck Fan & Ventilator Corp. Low velocities. Weatherproof housing. No unsightly curb mountings. New catalog has details, specs.
Page 145 Item 280

GALVANIZED SHEET .....
from Inland Steel withstood the fast ball of American League pitcher Billy Pierce without a trace of flaking. Information is available.
Page 146 Item 281

PREFABRICATED INSULATED PIPING ..
from Ric-wiL was specified and installed for the underground piping system at award-winning Linton High School. Information is available.
Page 148 Item 282

AIRFOIL FAN .....
from Clarage Fan Co. tops all others where it counts—on the job. It is perfected for mechanical draft and heavy duty applications. Catalog is available.
Inside Back Cover Item 283

NEW LOAD LIMITING RELAY .....
for positive protection against motor overloading is offered by Johnson Service Co. It is a superior limiting device for use with pneumatic control system. Bulletin is available.
Back Cover Item 284

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45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110

200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
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AIR CONDITIONING, HEATING and VENTILATING
93 WORTH STREET
NEW YORK 13, N. Y.

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BOOKS TO HELP YOU WITH YOUR DESIGN PROBLEMS

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by F. W. Hutchinson

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Completely new book containing thousands of facts, figures, data and principles; hundreds of charts, tables and maps. Answers problems you face every day in your work. Subjects treated thoroughly include: Air Conditioning, Air Handling, Building Heat Loss, Climatic Data, Combustion, Degree-Days, Dual Duct Design, Dust Collection, Fuel Estimating, High Velocity Air, Mathematics, Motors, Piping and Plumbing, Psychrometry, Radiator Heating, Refrigerants, Service Hot Water, Solar Data, Steam Flow, Ventilation, Warm Air Heating, Terminology and a complete cross index. 1094 Pages, 7¾" x 10¾", 598 Charts, Maps, Illus., 518 Tables, $15.00.

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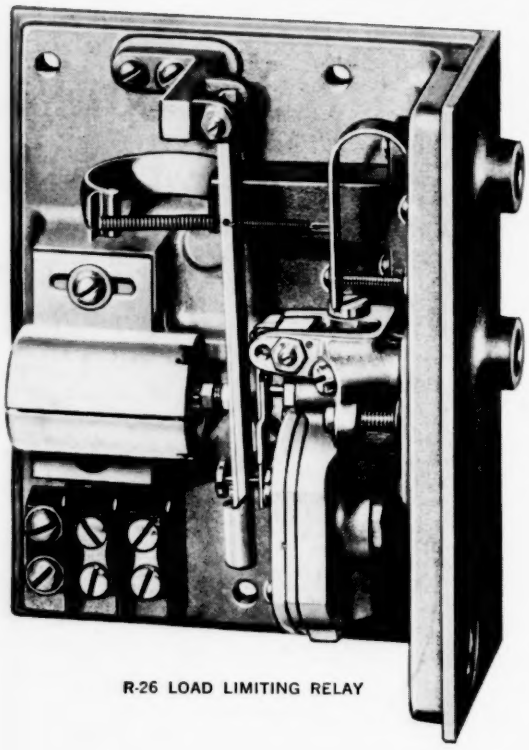

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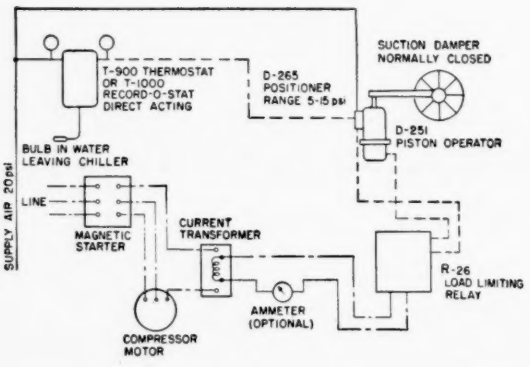
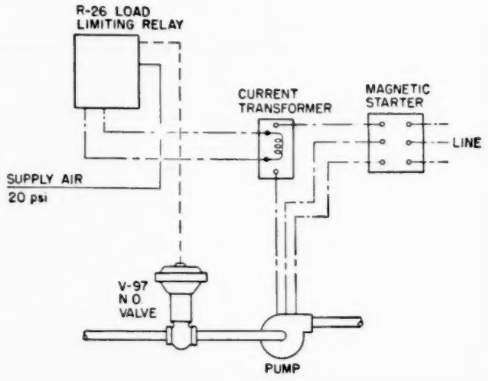


Load Limiting Relay used with piston operator for overload protection of centrifugal refrigeration compressor.



Load Limiting Relay applied to pump installation.

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